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Dr. Ram Prasad's report on the utilisation of Jog Power in the Southern area of the B'bay Province.

(Accompt. to file No: 2004/36.)

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File No. 2004/36.

REPORT ON THE

JOG KARNATAK ELECTRIC GRID SCHEME

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Report on the

JOG - KARNATAK ELECTRIC GRID SCHEME.

Chapter I.

GENERAL

Introductory :-

The Karnatak area of the Bombay State is potentially -tially rich in resources of Hydro-Electric Power and raw materials for the development of industries. But the area remains underdeveloped due to several factors one one of which is absence of cheap electric power. Preli-minary investigations of the Kalinadi Basin have shown a large potential for the development of Hydro electric power. This source may take at least 8 to 10 years under the present circumstances for development. However, the development of the Jog Falls Project by the Mysore Government utilising the waters of the Sharavati River, which flows along the borders of both Mysore and Bombay States, has afforded a means of making electric power available to a restricted area of Karnatak within the course of 3 to 4 years. The present report deals with a project for the distribution of 10,000 kW available at Jog and 1,500 kW available at Harihar to a few industrial and rural load centres in the Karnatak.

Negotiations with Mysore Government.

Before any actual construction works for the Jog Falls scheme were started, the Mysore Government had discussed with the Bombay Government about the sharing of the waters of the Sharavati River and as early as in 1929-1930, it was agreed that Mysore Government could develop a shheme capable of generating 20,000 E.H.P. and of this Bombay Government should get 5,000 E.H.P. xxxxxxxxxxxxxxxxxxxxxxxxxx

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In 1943, the Mysore Government decided to develop 64,000 E.H.P. without any further consultation with the Bombay Government and this stage of development is now complete. They have further under execution the second stage, which brings the total installation at the Mahatma Gandhi Power House at Jog to 120,000 kW.

The question of utilization of Jog Power in Bombay Karnatak was not considered till the Bombay Electric Grid Department was formed. In order to obtain more than 5,000 E.H.P. promised by Mysore Government and also to get it at a rate cheaper than 0.25 an./unit proposed by Mysore, considerable correspondence took place between the two Governments. Later at a Conference of the Hon. Ministers of the two Govts. held at Bangalore on 22-5-1948 the Mysore Government agreed to supply 10,000 kW in the first instance from their existing Jog Power House and promised to give priority to another 20,000 kW when the further stage was completed. Regarding the rate of supply also, they said that Bombay Government could work out three schemes assuming 0,2, 0.15 and 0.125 an./unit.

Based on these figures, a detailed scheme was worked out for the distribution of 30,000 kW in Karnatak and submitted to Government by the Electrical Commissioner on 30-8-1948. But later, when the Mysore Government were requested to confirm the above quantum of Power and the rate of supply, they reiterated their old rate of 0.25 an./unit for supply at the 110 kV busbars at Jog and limited the power to be made available at Jog to 5,000 E.H.P. They were, however, prepared to give an additional 6,000 kW at 66 kV at Harihar, for which they sent a schedule of rates which was comparatively much higher than the Jog rate.

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At this stage, the Bombay Government decided upon negotiations at ministerial level with the Mysore Government for power supply from Jog and accordingly a second conference of the Hon. Ministers of the two Governments was held at Bangalore on 10-2-1949. The Bombay delegation requested for the supply of 15,000 kW at Jog at cost of generation plus 5% and 1,500 kW at Harihar on a similar basis. The Mysore Government did not agree to meet these requirements of Bombay. It was ultimately agreed to, at the Conference that (a) They Mysore Government will give a "Minimum" of 10,000 kW at Jog and 1500 kW at Harihar and (b) the rate of supply at Jog to be 0.225 an./unit (a little less than the original rate of 0,25 an./unit) and the rate at Harihar the same as communicated by them earlier but subject to a new minimum charge and period of contract.

Approval by Government.

After this Conference, further proposals were submitted to Government on 14-4-1949 by the Electrical Commissioner based on the limited quantum of power available from the Mysore Government. This proposal was approved by Government in their letter No.2004/36-V-El dated 29-7-1949 and as directed in that letter, the detailed plans and estimates are being submitted in this report.

Area to be served.

The limited quantity of power viz.,10,000 kW at Jog and 1500 kW at Harihar cannot be distributed to the whole of Karnatak as it would be both inadequate and uneconomical. Hence the scheme is restricted to the Kanara and Dharwar districts and further the supply will be limited to 9 industrial and rural townships. The towns are Sirsi, Hanagal (500 kW for rural distribution), Dandeli, Hubli, Gadag and Dharwar on---

on the Jog section and Ranibennur, Byadgi and Haveri on the Harihar section. Some 1000 kW will be distributed in the rural areas arond Hanagal and Ranibennur-Haveri Sections.

Main features.

The proposed routes of transmission lines and load centres for the scheme are shown in the enclosed drawing No. J/241. They consist of 122 miles of 110 kV double circuit line with one circuit strung at the commencement connecting Jog power House with Hubli and Dandeli, 64 miles of 33 kV single circuit lines connecting Hubli with Gadag and Byadgi with Harihar, 23 miles of 11 kV double circuit line connecting Sirsi with Hanagal, 23 miles of 11 kV. single circuit lines connecting Dharwar with Hubli and Haveri with Byadgi and 22 miles of 11 kV Distribution lines. Provision has also been made in the estimates for rural distribution. The actual routes and lengths will be known when the transmission line surveys are completed. The sub - stations vary in size from 7000 kVA to 1000 kVA. The layouts of the different sub-stations are shown on Drawing No. J/391 to J/400. Towns of Hubli, Dharwar, Gadag, Sirsi, Ranibennur, Haveri, Byadgi, Hanagal and Dandeli will be supplied with electricity. Besides, textile, oil, paper alumina and match industries, railway and other workshops, small lift irrigation pumping and other rural loads will be supplied from the scheme. In order to save time during construction and erection, standard equipment and "Unit Substations" are proposed to be installed.

Present stage of the scheme.

Government have approved the surveys of transmission line routes and sub-station sites being entrusted to a contractor and accordingly the survey work has been

entrusted--

entrusted to a firm of contractors and the field work was commenced in March, 1950. The survey is expected to be completed by March, 1951.

Tenders for sub-station equipment viz. Transformers, switchgear and Synchronous Condensers have been received through the Director General of Industries and supplies and have been scrutinized and on the recommendations of this Department Government have approved placing orders. Application for the allocation of the necessary foreign currency has been ~~made~~ granted and orders ~~will be~~ have been placed ~~as soon as Government of India allocate it~~ through the Director General of Industries & Supplie

The specifications for the main 110 kV and 33 and 11 kV transmission lines are sent to the Director General of Industries and Supplies and he has been requested to invite tenders.

The work of preparing specifications for Civil Engineering works is held up for want of Civil Engineering Staff. When Government approves the recommendations made in this office u.o.r. No.T.8./12/11551 dated 26-5-1950, and appoints the staff, this work will also be taken up.

Construction Programme.

Based on the early delivery of American sub-station equipment and importing of transmission line materials from foreign countries giving short delivery periods, a construction programme of works has been prepared and enclosed as statement IV. From this it will be noticed that power supply from Jog may be commenced in April 1953.

Summary of cost and load figures.

The capital cost of the scheme contemplated in this report is made up as follows :-

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No.	Item.	Approx. cost in Rs. lakhs
1.	Surveys	1.51
2.	Transmission lines	86.89
3.	Sub-stations	64.16 (64.16)
4.	Civil Engineering Works.	25.11
5.	Rural Distribution.	27.41 (27.41)
	Sub total.	206.08
6.	Interest during construction.	6.98
	Total Capital cost:	213.06

The details of the estimates are found in the enclosed statement III.

LOAD Data.

The following are the demand maxima expected to be supplied from the various load centres.

No.	Load centre.	Maximum demand in kW At commencement.	Maximum demand in kW 3rd and subsequent years of service.
	Jog Hubli Section.		
1.	Sirsi	150	400
2.	Managal (Rural loads)	250	400
3.	Dandeli	2,400	4,100
4.	Hubli	2,650	3,600
5.	Gadag	700	850
6.	Dharwar	400	550
	Total load.	6,550	9,900
	Total diversified load	6,000	9,000
	Approximate demand at Jog (kW)	6,600	10,000
	Harihar-Haveri Section.		
7.	Ranibennur	450	650
8.	Byadgi	300	450
9.	Haveri	250	370
	Total load.	1,000	1,470
	Total diversified load	900	1,350
	Approximate demand at Harihar (kW)	1,000	1,500

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These load figures, except that of rural distribution around Hanagal, are as approved by the Government vide Government Letter No. 2004/36-V-E1(I) dated 11-5-50. Permission to include the Hanagal area also in the scheme has been requested in this office u.o.r. No. T8/3/15394 dated 7-7-1950. This has been approved vide G.L. No. 2004/36-E1(1) dated 28.9.1950. The details of the load are found in statement II.

Scope for future development.

The present proposal of distribution of power has to be confined to a few selected places as it is impossible to serve more centres due to economic considerations and the limited quantum of power available. It is however observed from the load data collected and the requisitions received by the Government and by the Electric Grid Department that there are a number of villages and towns clamouring for power. Power is needed by them both for industrial and lift irrigation purposes apart from the normal lighting. There is no doubt that even a growth of about 20,000 kW for the types of loads cited above may not be an over-estimate in a period of few years. The demand will be much higher if heavy metallurgical and electro chemical industries are encouraged. It may also become necessary to develop the Kalinadi Hydro-electric stations, one by one, at an early date after the completion of the Jog scheme unless it is possible to obtain additional power from the extensions to the Jog Falls power Development scheme. The present scheme may serve as the load builder for the larger Kalinadi Hydro Electric Project.

Financial Results.

The financial statement (Statement I of the enclosure is ---

is worked out in accordance with the Indian Electricity (Supply) Act, 1948. The rates proposed to be charged for different types of loads are reasonably low. The scheme is expected to become self-supporting in the 3rd year of service, when there will be an accumulated deficit of Rs. 2.72 lakhs. This amount will be wiped out in the next three years, after which the scheme will yield a net revenue of about Rs.0.88 lakh in the sixth year and about 1.25 lakhs in the seventh and subsequent years over and above the interest at 3½ % on the capital cost of the scheme and full allowance for depreciation and operation and maintenance.

Chapter II.

Technical Features.

Layout of the system.

The power available for distribution is at two places viz. Jog and Harihar. At the Mahatma Gandhi Power House at Jog 10,000 kW will be tapped off from the 110 kV buses. The Mysore Government will provide the necessary 110 kV Oil Circuit Breaker and the required protective and metering equipment at Jog. At the Harihar sub-station of Mysore Govt. 1500 kW will be available at 66 kV. Here, the Bombay Government will have to construct one or two spans of 66 kV line including the Tungabhadra river crossing and also provide the necessary 66 kV oil circuit breaker and protective equipment. The transmission systems will operate at 3 phase, 50 cycles with solidly grounded neutral.

In the present scheme it is proposed to distribute the power available from Mysore Government as follows :- A main 110 kV double circuit line with one circuit strung for the present will be constructed from Jog to Hubli and Dandeli with a switching station at Kavalvad. This line will also be tapped at Sirsi where a 1000 kVA, 110 kV/11 kV step down station will be installed to provide for the local and Hanagal (Rural loads) area loads. At Dandeli the voltage will be stepped down to 11 kV by a 5000 kVA transformer to provide for the industrial loads anticipated at Dandeli. Hubli will be the main receiving station where the voltage will be stepped down to 33 kV by a 2000 kVA transformer to feed Gadag and to 11 kV by a 5000 kVA transformer to feed the local loads and Dharwar town. Two 2000 kVA synchronous condensers will be installed at Hubli for voltage regulation and power factor improvement. The 33 kV line will terminate at Gadag where --

where the voltage will be stepped down to 11 kV by a 2000 kVA transformer to meet the local demands.

The distribution from Harihar will consist of a 2000 kVA step down station from 66 kV to 33 kV at Harihar and a 33 kV single circuit line to Byadgi. This line will be tapped at Ranibennur where the voltage will be stepped down to 11 kV by a 1000 kVA transformer to meet the local demands. At Byadgi also the voltage will be stepped down to 11 kV by a 1000 kVA transformer to meet the local and Haveri town demands An 11 kV single circuit line will run from Byadgi to Haveri. At the above 3 substations viz. Ranibennur, Byadgi and Haveri, surplus power to the extent of about 500 kV will be left which is proposed to be distributed in the rural areas round about these places. The cost of distribution roughly estimated at Rs. ~~30.70~~ 27.41 lakhs is included in the estimates covered by this report. It is proposed to send to Government a revised proposal for the rural distribution after the load survey of the Hanagal and Ranibennur-Haveri areas are completed.

The proposed transmission line routes, electrical layout and the layout of equipment at the various sub-stations are shown in the drawings enclosed with this report.

110 kV transmission line.

The main 110 kV Transmission line from Jog to Hubli and Dandeli is about 122 miles in length and will be so routed that the present net work forms an integral part of the future Kalinadi scheme. The Jog-Sirsi line can also be retained as a tie line between the Jog and Kalinadi sheemes. It will be a single circuit line for the present but strung on double circuit towers. The line will be of 0.1 sq.in. copper equivalent A.C.S.R. conductor in vertical configuration

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with a single 7/9 S.W.G.galvanised steel earth wire mounted on the apex of the towers. The outlines of the towers proposed to be used are shown in drawing No. J. 292 enclosed. Double circuit towers are proposed to be used in order to facilitate transmission of more power at a future date if the Mysore Government agrees to supply or to transmit power from the Kalinadi Scheme on the same line or to tie Kalinadi and Jog Schemes. The Mysore Government are likely to be agreeable for this link. The towers to be used will be galvanised steel towers. The main line will pass mostly through forest area. The towers will be spaced normally at 1050 ft. spans and each will be earthed efficiently. There will be about four major river crossings. Only the crossing at the Sharavati River will require special towers.

The wind pressure prevalent in the area is 10 to 15 lbs./s.ft. The line is designed for a wind pressure of 15 lb.per sq.ft. The towers and conductors will be suitably designed to give a factor of safety of 2.5 under normal conditions and 1.5 under broken wire conditions. The design of the towers is made after due consideration of direct lightning strokes on the line. The height of the normal suspension tower will be 86'-6". The A.C.S.R. conductor, which will be equivalent to 0.1 sq.in copper, will be of stranded aluminum made up of 6 strands of 0.186" on a stranded steel core of 7 strands of 0.062". Anti-vibration dampers of approved design, will be used at all points. Suspension type insulators of standard manufacture will be used. Tangent locations will have each seven discs of 10" diameter at 5½" centres, and tension and angle towers will have strain units of seven discs each. +There will be 5 complete barrels of transposition. There will also be a telephone line on separate poles from--

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from Jog to Hubli and Dandeli running parallel to the Power line at a distance of about 600 ft.

The regulation of the line upto Hubli or Dandeli sub-station will be about 5.5 %.

To take care of the charging current of the line as well as to improve the power factor and to regulate the voltage at Hubli, it is proposed to instal two synchronous condensers, each of 3000 kVA (leading) capacity.

33 kV and 11 kV lines.:

The 33 kV and 11 kV transmission and distribution lines will be single circuit lines except 23 miles of double circuit 11 kV line from Sirsi to Hanagal. These lines will be carried on steel, R.C.C.,rail or treated wood poles and fitted on pin type insulators. The conductors will be strung in horizontal formation for the single circuit lines and in the vertical formation for double circuit lines. Drawing Nos. J 348 and J 349 give a general idea of the 33 kV and 11 kV line supports proposed. The design of the poles and conductors will be made on the basis of a factor of safety of 2.5 under normal working conditions and 1.5 under broken wire conditions. Stranded hard drawn copper conductors will be used for these lines. The insulators will be of standard make. The telephone wires will be strung on insulators mounted on the same poles carrying the power conductors. The insulation level proposed to be adopted for the telephone lines on the same supports is 6.6 kV, which has proved satisfactory in service elsewhere. The 33 kV lines will be transposed where necessary.

The following table gives the technical details of the 33 kV and 11 kV lines for both Jog-Hubli and Haribar-Haveri sections.

No.	Route.	Approx. length in miles.	No. of Circuits.	Voltage in kV	Section of copper in Sq.in.	Estimated load per circuit in kW.	%regulation of line @ 0.9 p.f.
	Jog-Hubli Section.						
1.	Sirsi-[illegible] Kanagal	23	2	11	0.04	250	6.90
2.	Hubli-Gadag	37	1	33	0.06	900	3.06
3.	Hubli-Dharwar	12	1	11	0.06	600	6.09
	Hawihar-Haveri Section.						
4.	Harihar-Ranibennur	14	1	33	0.04	1500	2.86
5.	Ranibennur-Byadgi	13	1	33	0.04	900	1.44
6.	Byadgi-Haveri.	11	1	11	0.04	400	5.30

Provision for 22 miles of 11 kV distribution lines has been made in the estimates for taking 11 kv feeders upto the consumers premises.

Lumpsum provision has been made for rural distribution in the present estimates.

Sub-stations.

The sub-stations proposed to be installed for this scheme are of the outdoor type, which are available in standard units and will be pre-fabricated so that erection time and cost will be minimum. Also the outdoor structures will be compact and the space required for the sub-stations will be reduced.

In this scheme, there are in all 11 sub-stations of which 7 sub-stations have step-down transformers and one sub-station is a H.T. switching station. Spare transformers are provided at all the transformer sub-stations.

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Particulars---

Particulars of equipment.

A brief description of the equipment to be provided at each sub-station and the service for which they are meant is given below. All the sub-stations are complete with the necessary H.T. and L.T. switchgear, cables, metering and protective equipment, station service equipment and staff quarters.

(a) Jog : There is no need for the Bombay Government to provide any equipment at Jog as the necessary Oil Circuit Breaker, lightning arrestors and structures are provided by Mysore Government. The Bombay Government will, however, have to instal an anchor tower near the Mysore Government's structure and put in a jumper from the disconnecting switch that has been installed by Mysore Government.

(b) Sirsi :- This is a tapping station from the 110 kV transmission line and is situated at a distance of about 33 miles from Jog. A 1000 kVA transformer sub-station is proposed to be installed here to meet the local and Hanagal area demands. The voltage is directly stepped down to 11 kV and fed to the consumers' terminals through 2 feeders and also to Hanagal by separate feeders.

(c) Kavalvad :- This is only a switching station at a distance of about 79 miles from Jog. Here, the 110 kV line branches off, one towards Hubli and the other towards Dandeli. 110 kV Oil Circuit Breakers are provided for the outgoing lines.

(d) Dandeli :- This is about 19 miles from Kavalvad and an important sub-station of the scheme. It will serve the demands of heavy industries like Pulp and Paper Mills and Alumina refining plants. It will also become an important sub-station for the Kalinadi scheme. A 5000 kVA 110 kV/11 kV step down transfofmer will be provided at this sub-station with another ~~ex~~ as---

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as spare and from the 11 kV bus, the consumers will be fed by means of five feeders.

(e) Hubli : This is the main Receiving station for the system. It is about 24 miles from Kavalvad and is important on account of its central location as well as being the most important load centre for the scheme. From this station, supply is proposed to be made to Gadag at 33 kV and to Dharwar at 11 kV. This station has a 5000 kVA 110 kV/11 kV transformer with 9 feeders on the L.T. bus. Of these, one feeder is outgoing to Dharwar, two are for the 3000 kVA synchronous condensers and the remaining for local consumers. There is another 2000 kVA transformer stepping down from 110 kV to 33 kV which feeds the 33 kV single circuit line to Gadag. There is also a 5000 kVA 110 kV/33 & 11 kV double wound transformer to serve as common spare.

(f) Gadag : This sub-station is about 37 miles from Hubli and consists of a 2000 kVA, 33 kV/11 kV transformer with the necessary protective equipment on either side. From the 11 kV bus, 4 outgoing feeders supply the necessary power to local consumers.

(g) Dharwar :- This will be a feeder sub-station with no voltage transformation but only one incoming and 2 outgoing 11 kV Oil Circuit Breakers for two feeders.

(h) Ranagal : This will also be a feeder sub-station with 2 incoming and 2 outgoing 11 kV O.C.B. circuits.

(i) Harihar :- The Mysore Government will supply power from their 66 kV line at Harihar and as power to our sub-stations is being transmitted at 33 kV, it is necessary to have a 66 kV/33 kV sub-station on the Bombay side of the Bombay-Mysore border. This Sub-station consists of a 2000 kVA, 66 kV/33 kV transformer with the necessary O.C.B.s on either side. There will also be a spare 2000 kVA 66 kV/33 kV transformer.

transformer.

(j) Ranibenhur:- The 33 kV Harihar Byadgi line will be tapped at a distance of 14 miles from Harihar to supply power to Ranibennur. A 1000 kVA 33 kV/11 kV transformer is provided with the other necessary equipment and 3 feeders are provided for local distribution.

(k) Byadgi :- This is the terminal sub-station for the Harihar Byadgi 33 k-V line. Here the voltage is stepped down to 11 kV by a 1000 kVA transformer and 2 feeders are provided for local consumers and a third feeder for Haveri.

(l) Haveri : This is a feeder sub-station similar to Dharwar with no voltage transformation but only with one incoming and 2 outgoing 11 kV O.C.B. circuits for feeders.

The voltages adopted for secondary transmission are lower than would appear normal to save an initial cost. Liberal use of induction regulators is contemplated to compensate for this when load develops.

Protection:-

Lightning arrestors will be provided for all the incoming lines and outgoing feeders at all the sub-stations.

The earth conductors and steel structures at all sub-stations will be efficiently earthed to a station ground bus.

The main 110 kV Jog-Hubli line will be protected by high speed earth leakage and plain overcurrent and earth-leakage relays. The 33 kV line from Harihar will also be protected similarly. The other 33 kV and 11 kV lines and feeders are protected by plain overcurrent and earth-leakage relays.

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Chapter III.

Loads and Revenue.

Demand for Power : There is a considerable demand for power both in urban and rural areas of the four districts of Karnatak viz. Belgaum, Kanara, Dharwar and Bijapur. The types of load are varied in the urban areas, with industrial loads predominating while in rural areas, the main loads are those due to lift irrigation pumping and small flour, ginning and rice mills. There is also a demand for lighting loads, this being more prominent in towns and cities. As commercial crops like cotton and oilseeds grow in abundance in Bijapur and Dharwar districts, there is in particular, demand for textile and oil industries. There are sources of forest and mineral wealth which will require large quantum of power for development. But as noted earlier, these industries have not developed properly for want of cheap electric power or fuel such as coal and oil which have to be transported from long distances and are, consequently, costly. Electricity will be in great demand for domestic, agricultural and industrial purposes in the area.

Types of load.

All the main types of load viz. industrial agricultural and domestic are covered in this scheme. Though restricted in area and quantity an attempt has been made to meet all the demands of the towns to be supplied with Jog Power. Hence while meeting the demands of the paper and aluminium industries in the initial stages, an alternative large source of supply has to be thought of to meet the full demand of these industries, in the course of the next 5 or 6 years when the 10000 kW of power available from Jog is fully utilized. While preparing this report, it ...

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it is assumed that the Kalinadi project will be executed within a few years after the completion of Jog Karnatak scheme so that the former will take over the demand of Jog Karnatak scheme immediately when it is ready and also supply the additional loads that have developed during the period.

There are possibilities of the development of ferrometallurgical, cellulose and heavy chemical industries, in the Kanara district but their consideration is beyond the scope of this report.

Detail of loads at various load centres are given in the following paragraphs.

Licensees:- Among the load centres provided for in this scheme, Hubli, Dharwar , Gadag, Haveri, Byadgi and Ranibennur are electrified towns and have licensees loads. All these places have licensees except Hubli, which is now operated by Government.

These power stations are worked by diesel sets and the cost of generation is very high. The rates and conditions of supply of Jog power to these licensees will be quite attractive to them and there will be no difficulty in changing over. But in Gadag and Haveri where there is D.C. supply at present, some diffieulty may have to be experiecned during the change over from D.C. to A.C. supply.

Sirsi town will have a new licensee. There is no provision for a separate licensee at Dandeli as the Colonies of the factories contemplated may receive domestic power from their factory sub-stations. Hangal may require the Government to distribute power in the town as there is no licensee.

Agricultural industries:-

As noted earlier, the area to be served with Jog power is rich in raw cotton and oil seeds. The requirements of the existing Textile mills at Hubli and---

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and Gadag have been considered in the report.

The existing small oil mill at Ranibennur is expected to expand and its requirement of 150 kW has been included.

Cotton-ginning load is not considered in this scheme for want of adequate power and also because it yields very poor revenue on account of its seasonal character and consequent poor load factor.

There is a possibility of one or two new textile mills at Hubli and Gadag being developed but they are not considered in this report on account of the shortage of power available.

Forest industries :-

Industries based on forest wealth viz. one Match Factory at Sirsi (300 kW), Pulp and Paper Mill at Dandeli (1400 kW) are provided in the estimate of loads.

There is a possibility of two or three more paper mills developing in this area but this is not considered here as no extra power is available.

Mineral industries :-

An alumina refining plant absorbing 3000 kW, proposed to be situated at Dandeli is provided for in the estimates. Aluminium reduction plant, requiring a large block of power, is not considered here as sufficient power is not availble from Mysore Government.

Rural loads:-

The requirements of the Hanagal area and those around Ranibennur, Byadgi and Haveri are mainly agriculturists requirements like small lift irrigation pumping, flour and rice mills etc. which are included in the estimates. The total power proposed to be distributed in this manner is about 1000 kW. Only lump sum provision for L.T. distribution is made in the estimates covered by this report.

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Other---

Other loads:

Among the other loads are the M.S.M.Railway workshop load at Hubli, which will be 650 kW to start with and rising to 850 kW., Plywood factory at Dharwar (200 kW), Government saw mills at Dandeli (160 kW) and other small loads.

Rate Structure:-

The rates chargeable to the consumer are dependent on two factors (i) the rate payable to Mysore Government and (ii) transmission and distribution charges. As we are obtaining bulk supply from a Hydro electric power station, there will be no clause to compensate for the variation in the price of fuel.

Based on the rates payable to Mysore Government and also the load and load factor and the national importance of the industry, the rates proposed to be charged for different consumers are arrived at. These rates are comparable with the rates elsewhere and are certainly cheaper than available in any thermal plant, which any industry may think of, as an alternative to this supply. The following table shows the rates proposed for the various consumers.

No.	Type of load.	Average Rate in An./unit
	JOG-HUBLI SECTION:	
1.	Town supply	1.00 Anna/unit
2.	Match factory.	0.85 "
3.	Saw mills and Plywood factory.	0.90 "
4.	Paper Mills.	0.55 "
5.	Aluminium industry.	0.40 "
6.	Textile mills.	0.85 "
7.	Railway workshops.	0.90 "
8.	Rural load.	2.00 "
	HARIHAR-HAVERI SIDE	
1.	Town supply.	1.00 An./Unit
2.	Industrial load.	0.90 "
3.	Rural load.	2.00 "
4.	Oil Mills.	0.90 "

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For licensees, the energy will be delivered at 11 kV at their present power houses and the cost of 11 kV feeders is included in the report. For all

all other classes of loads, except Rural, the supply is presumed to be delivered at 11 kV busbars at the respective sub-stations and the consumers pay for the cost of service connection charges, minus the free service allowance (For Rural distribution the rates proposed are at L.T. voltages

Loads and revenue forecast:-

A statement showing the loads, units and revenue is found in statement II attached to this report, but a summary of the 1st and 3rd and subsequent years of service are noted below for ready reference.

No.	Type of load.	First year of service			3rd and subsequent years of service.		
		Demand in kW.	Units sold in millions.	Revenue in Rs. lakhs.	Demand in kW.	Units sold in millions.	Revenue per annum in Rs. lakhs.
	JOG-HUBLI SECTION						
1	Town supply.	1940	5.95	3.72	3190	9.80	6.13
2	Match factory.	100	0.433	0.23	300	1.314	0.69
3	Saw mills and plywood factory.	310	0.734	0.454	360	0.946	0.53
4	Paper Mills.	500	3.50	1.20	1400	9.80	3.37
5	Aluminium industry	2000	15.80	3.92	3000	23.60	5.90
6	Textile Mills.	1800	8.68	4.62	1900	9.13	4.84
7	Railway workshop	670	2.06	1.16	870	2.67	1.50
8	Rural load.	300	0.79	0.09	500	1.32	1.65
	Total	7620	38.02	16.29	11520	58.58	24.61
	Total diversified load. KW.	6000			9000		
	Total No. of units purchased in millions		41.82			64.44	
	Amount payable to Mysore Government Rs. lakhs.			5.90			9.05
	HARIHAR-HAVERI SECTION:						
1	Town supply.	360	1.11	0.69	600	1.84	1.14
2	Industrial load	310	1.36	0.77	400	1.75	0.98
3	Rural load	320	0.84	1.06	500	1.32	1.64
4	Oil Mills.	200	0.88	0.49	350	1.10	0.60
5	Total.	1190	4.19	3.01	1750	6.01	4.36
	Total diversified load.kW	900			1350		
	Total No.of Units purchased in millions		4.61			6.61	
	Amount payable to Mysore Govt. Rs.lakhs			1.63*			1.79

*Minimum amount payable to Mysore Govt.

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Chapter IV.

Financial Aspect.

Capital Cost :-

The estimate of costs have bee worked out on the following basis:

(i) Surveys - Rates as per contract already awarded.
(ii) Transmission Lines - Rates as per orders placed for the South Gujarat Grid Scheme with an addition of 10% for possible price increases.
(iii) Sub-stations - Rates as per order already placed on the basis of firm prices.
(iv) Civil Engineering Works - Rates based on similar works under the North and South Gujarat Grid Schemes.
(v) Rural distribution - Lump sum provision based on assumed rate pe rate per kW distributed applicable to the area.

The total estimated capital cost of the scheme covered in this report is Rs.213 lakhs, which includes about Rs. 7 lakhs as capitalised interest charges incurred during the construction period. Abstract of estimates under the different main classifications is given in statement III. Detailed estimates are in this office files. Works will be executed mostly by contract. In preparing the estimates, the following percentages have been allowed :-

(i)	Tools and Plant.	1½ %
(ii)	Workecharged establishment	2 %
(iii)	Contingencies.	5 %
(iv)	Establishment , Head office and General charges.	8½ %

Rates of purchase :

Power will be purchased from two centres of Mysore Government and the rates payable are according to the decisions arrived at, at the Hon. Ministers' Conference held at Bangalore on 10-2-1949. The final rates arrived at are as follows :-

(a) The rates of supply at the 110 kV bus at Jog is 0.225 An./Unit.

(b) (i) The rate of supply at 66 kV. at Harihar is according to the schedule given below :-

No.----=

No.	Class and total monthly consumption in KWH.	Rate per KWH as.		Rate per month per KW of max.demand.
1	Upto 1,00,000	0.450		
2	Between 1,00,000 & 1,50,000	0.425		Rs. 3/- upto
3	Between 1,50,000 & 2,00,000	0.400	P L U S	1000 kW.
4	" 2,00,000 & 3,00,000	0.375		Rs.2/12/- for 1000 kW.& over.
5	" 3,00,000 & 5,00,000	0.350		
6	" 5,00,000 &10,00,000	0.325		
7	Beyond 10,00,000	0.300		

(b)(ii) A minimum of Rs.1.525 lakhs per annum will be payable by Bombay Government and the minimum period for which the agreement for taking power and payment of the minimum charge is to be executed will be ten years.

Rate of supply:-

Notwithstanding the appreciable difference in the bulk power rates in the two areas, re-sale rates have been kept uniform treating the whole scheme as one unit. In working out the financial statement, the rate proposed under "Rate Stucture" in chapter III are adopted. It will be for consideration of Government at the appropriate time whether these rates would be reduced after 10 years of service, when the scheme is expected to yield a surplus of about Rs.1.25 lakhs per annum for the combined scheme which is only about half percent above the interest of 3½ %.

Interst:-

The interest charges are calculated at 3½% in the same way as for the other Electric Grid Schemes.

The interst charges on the capital invested during the construction period are capitalised and added to the capital cost. Interst at 3½% is also taken into account towards any balance of interst charges remaining unpaid during any year.

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Depreciation--

Depreciation:-

Depreciation charges are worked out according to the provisions set down in the Electricity (Supply) Act, 1948. Details are found in statement V and the average comes to 2.1½ % of the capital cost. But 2 % is adopted in the financial calculations.

Operation and Maintenance:-

The operation and maintenance charges are estimated to be 2.5 % of the capital cost and details are worked out as per statement VI.

Financial Forecast:-

The financial forecast, (statement I) is worked out by taking into consideration only revenue due to the rates of supply proposed. Electricity duty recovered will be an additional income to Government and it is not taken into account in the financial statement. Afterwards, allowances are made for the working charges in the following order as set down in the Electricity (Supply) Act, 1948. Firstly charges to Mysore Government are paid off, next the operation and Maintenance charges, thirdly depreciation and finally interest charges. Whatever charges are not paid during a particular year are carried forward and interest at 3½% paid on it. By this method, it will be seen that Rs. 3.97 lakhs will be the accumulated deficit at the end of 2 years of service and that this amount will be wiped out in another four years, after which period, the scheme will yield a surplus of about Rs.0.88 lakh in the sixth year of service and about Rs. 1.25 lakhs from the seventh and subsequent years.

ISB/22.9.50.

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S. No.	Type of load	Annual load factor.	Rate per unit As.	First year of service.					
				Sirsi kW	Dandeli kW	Hubli kW	Gadag kW	Dharwar kW	Hanagal kW.
1.	Town Supply	0.35	1.00	90	-	1000	500	350	-
2.	Match Factory	0.50	0.85	100	-	-	-	-	-
3.	S.Mills & P.Factory.	0.30	0.90	-	100	-	-	150	-
4.	Paper Mills	0.80	0.55	-	500	-	-	-	-
5.	Aluminium plant	0.90	0.40	-	2000	-	-	-	-
6.	Textile Mills	0.55	0.85	-	-	1500	300	-	-
7.	Railway Workshop	0.35	0.90	-	-	650	20	-	-
8.	Rural Load.	0.30	2.00	-	-	-	-	-	300
9.	T o t a l.			190	2660	3150	820	500	300
10.	Total diversified load kW.			150	2400	2650	700	400	250
11.	Total load diversified between substations.								
12.	Total No.of units sold (million kWh)								
13.	Total No.of units to be purchased at Jog (with 10% loss) (million kWh)								
14.	Amount payable to Mysore Govt. per annum @ 0.225 as./unit (Rs.lakhs.)								

ISB/26.9.50.

JOG KARNATAK ELECTRIC GRID SCHEME

Statement of loads, Units and Revenue (Jog Hubli Section)

			Second year of service								
otal cal	Units sold/ Ann. (Mill -ion kWh)	Reve -nue Rs. lakhs	Sirsi kW	Dan- deli kW	Hubli kW	Gadag kW	Dhar -war kW	Hana -gal kW.	Total local kW	Units sold/ Ann. (mill -ion kWh).	Reve -nue Rs. lakhs
1940	5.95	3.72	120	-	1500	550	400	-	2570	7.90	4.94
100	0.44	0.23	200	-	-	-	-	-	200	0.88	0.47
310	0.80	0.45	-	160	-	-	170	-	330	0.87	0.49
500	3.50	1.20	-	1000	-	-	-	-	1000	7.00	2.40
2000	15.80	3.92	-	2500	-	-	-	-	2500	19.80	4.95
1800	8.68	4.62	-	-	1500	350	-	-	1850	8.91	4.75
670	2.06	1.16	-	-	750	20	-	-	770	2.36	1.33
300	0.79	0.99	-	-	-	-	-	400	400	1.03	1.29
7620		16.29	320	3660	3750	920	570	400	9620		20.62
6550			250	3300	3100	800	500	350	8300		
6000									7600		
	38.02									48.75	
	41.82									53.63	
		5.90									7.55

Statement II
Sheet 1

Third and subsequent years of service.								
Sirsi kW	Dandeli kW	Hubli kW	Gadag kW.	Dharwar kW.	Hangal kW	Total local kW	Units sold/ Ann. (million kWh)	Revenue Rs. lakhs.
150	-	2000	600	440	-	3190	9.80	6.13
300	-	-	-	-	-	300	1.31	0.69
-	160	-	-	200	-	360	0.95	0.53
-	1400	-	-	-	-	1400	9.80	3.37
-	3000	-	-	-	-	3000	23.60	5.90
-	-	1500	400	-	-	1900	9.13	4.84
	-	850	20	-	-	870	2.67	1.50
	-	-	-	-	500	500	1.32	1.65
	4560	4350	1020	640	500	11520		24.61
400	4100	3600	850	550	400	9900		
						9000		
							58.58	
							64.44	
								9.05

620

Statement III(a)

JOG KARNATAK ELECTRIC GRID SCHEME

1. Abstract of Estimates:

		Rs. Lakhs.
I.	Surveys.	1.51
II.	Transmission Lines.	86.89
III.	Substations.	64.16
IV	Civil Engineering Works.	26.11
V	Rural Distribution.	27.41
	Total Rs.	206.08 lakhs.

2. Distribution of Capital Expenditure.

All amounts are in Rs. lakhs.

No.	Particulars.	1950 -51	1951 -52.	1952 -53	1953 -54	1954 -55	1955 -56	Total.
I	Surveys.	0.50	1.01	-	-	-	-	1.51
II	Transmission Lines.	-	43.50	34.80	8.59	-	-	86.89
III	Sub-stations.	11.50	34.40	12.58	5.68	-	-	64.16
IV	Civil Engineering Works.	-	7.83	15.66	2.62	-	-	26.11
V	Distribution.	-	-	9.22	11.40	4.60	2.19	27,41
		12.00	86.74	72.26	28.29	4.60	2.19	206.08

ISB/14.10.

Statement No.III(b)
Sheet 1.

I ESTIMATE FOR SURVEYS:

	Rs. Lakhs.
(1) Survey of 110 kV, 33 kV and 11 kV. Transmission Lines and Sub-stations.	1.141
(2) Special tools and Plant and Scientific and Mathematical Instruments.	0.060
(3) Transmport Equipment and Maintenance.	0.124
	1.325
(4) Contingencies 5 %.	0.066.
	1.391
(5) Establishment, Head Office and General Charges. 8 ½ %.	0.118
(6) Total....	Rs. 1.509 lakhs.
	Say. Rs. 1.51 lakhs.

Note :- Out of this an estimate for Rs. 1,41,475 has been submitted to Government for administrative approval. The extra amount in the above estimate is for 23 miles of 11 kV. line survey from Sirsi to Hanagal and the Survey of distribution lines.

II. ESTIMATE FOR TRANSMISSION LINES.

Part A:- Transmission Lines.	Rs. Lakhs.
(1) Jog-Hubli-Dandeli Line:	
122 miles of 110 kV 0.1 sq.in. ~~Cu.Eq.~~ ACSR conductor single circuit line on double circuit towers @ Rs. 33,700 per mile.	44.114
(2) Hubli-Gadag line:	
37 miles of 33 kV 0.06 sq.in. copper conductor single circuit line on single circuit poles with telephone line on the same poles at Rs.16,800 per mile.	6.416
(3) Harihar (Mysore State) to 66 kV sub-station in Bombay State.	
Provision for the necessary river crossing span and 1 or 2 spans in Bombay State of 66 kV line..	0.500
(4) Harihar-Byadgi Line:	
27 miles of 33 kV 0.04 sq.in. copper conductor single circuit line on single circuit poles with telephone line on the same pole @ Rs.15,400 per mile.	4.158
(5) Hubli-Dharwar Line:	
12 miles of 11 kV 0.06 sq.in. copper conductor single circuit line on single circuit poles with telephone line on the same pole @ Rs.15,000 per mile.	1.800
(6) Sirsi-Hanagal Line:	
23 miles of 11 kV 0.04 sq.in. copper conductor double circuit line with telephone line on the same pole at Rs. 19500 per mile.	4.485
(7) 22 miles of 11 kV. Distribution lines @ Rs. 9700 per mile	2.134
	63.607
Part B: Tele-Communication:	
(8) Jog-Hubli-Dandeli Telephone Line:	
122 miles of telephone line on separate poles @ Rs.2000 per mile.	2.440

(9)-----

(9) Telephone equipment at Sub-Stations.		
(a) Jog	0.019	
(b) Sirsi	0.094	
(c) Kavalvad.	0.094	
(d) Dandeli	0.097	
(e) Hubli	0.125	
(f) Dharwar.	0.041	
(g) Gadag.	0.060	
(h) Haribar	0.060	
(i) Ranibennur	0.081	
(j) Byadgi	0.060	
(k) Haveri	0.041	
(l) Hanagal	0.041	
(m) Line camps.	0.105	
	0.918	3.358
		66.965
(10) Allowance for Rise in prices.		6.700
		73.665
Tools and Plant 1½ %		1.105
		74.770
Work charged Establishment 2 %		1.500
		76.270
Contingencies 5 %		3.810
		80.080
Establishment, Head Office and General charges 8½ %		6.810
		86.890

ISB/22.9.50

Statement No. III (b)
Sheet 3.

III ESTIMATE FOR SUB-STATIONS.

Abstract.

No.	Sub-station.	Rs. lakhs.
1.	Sirsi	4.701
2.	Kavalvad.	3.947
3.	Dandeli	6.386
4.	Hubli	17.582
5.	Gadag	3.091
6.	Dharwar	0.904
7.	Hanagal	1.195
8.	Harihar	4.152
9.	Ranibennur	2.929
10	Byadgi	2.905
11.	Haveri	0.904
12	3- 130 kVA, 11 kV Voltage regulators.	0.750
		49.456
	Erection.	4.950
		54.406
	Tools and Plants 1½ %	0.814
		55.220
	Workcharged Establishment 2 %	1.100
		56.320
	Contingencies. 5 %	2.820
		59.140
	Establishment Head Office & General charges 8 ⅓ %.	5.020
	Total Rs.	64.160

ISB/24.10.50

III. Estimate for Sub-Stations.

Details.

(1) Sirsi Substation:

(a) Outdoor Sub-Station consisting of -

(i) Steel structures, mountings insulators, busbars etc.

(ii) 1-110 kV outgoing Discon. Switches with grounding blades.

(iii) 1- 110 kV Discon. switch & fuses for the transformer.

(iv) 2-1000kVA 110/11 kV transformers provided with flat rollers one connected & 1 spare, and provided with one set of spares.

(v) 1-11 kV outdoor transformer O.C.B. with disconnecting switches, meters, instruments and relays.

(vi) 4-11 kV outdoor feeder O.C.Bs. with disconnecting switches, meters, instruments and relays.

(vii) 1 set - 11 kV. Potential Transformers with fuese disconnecting switches.

(viii) 1-25 kVA. 11 kV/0.4 or 0.22 kV. station service transformer with 11 kV. fuse disconnects and necessary outdoor Low Voltage equipment for 3 feeders.

(iv) 1 set 110 kV. station type lightening Arresters with live line disconnecting clamps and 1 operating pole.

(x) 4 sets 11 kV pellet type lightning arresters.

4·234

(b) Other connected works:
(i) Foundations & Trenches.
(ii) Sub-station lighting.
(iii) Sub-station Fencing.
(iv) Pulley block and Gantry.

Total 0.467

4·701

600

(2) KAVALVAD SUB-STATION.

(a) Outdoor sub-station consisting of -

(i) Steel structures, mountings, insulators, busbars etc.

(ii) 3-110 kV disconnecting switches with grounding blades, one incoming 2 outgoing.

(iii) 2-110 kV Disconnecting switches for the two O.C.B.s.

(iv) 1-110 kV single pole fuse disconnecting switches for the P.T.

(v) 2-110 kV 1500 MVA outdoor oil Circuit breakers with instruments and relays.

(vi) 1-48 V Battery and trickle charger mounted in weather proof cabinet.

(vii) 1-500 VA Single phase 1,15,000/115 volts Potential transformer .

(viii) 3 sets - 110 kV station type lightning arresters with live line disconnecting clamps and 1 operating pole.

Rs. 3.651

(b) Other connected works:

(i) Foundations and Trenches.

(ii) Sub-station lighting.

(iii) Sub-station fencing.

0.296.
3.947

Total Rs. lakhs

ISB/25.9.

601

(3) DANDELI SUB-STATION.

(a) Outdoor sub-station consisting of — Rs. lakhs.

(i) Steel structures, mountings, insulators, bus bars etc.

(ii) 1-110 kV disconnecting switch.

(iii) 1-110 kV fuse disconnecting. switches for the transformer.

(v) 2-5000 kVA 110/11 kV transformers provided with flat rollers, one connected, one spare, and provided with one set of spares.

(v) 1-11 kV outdoor transformer O.C.B. with disconnecting switches, meters, instruments and relays.

(vi) 5-11 kV outdoor feeder O.C.B.s with disconnecting switches, meters, instruments and relays.

(vii) 1 set - 11 kV potential transformers with fuse disconnecting switches.

(viii) 1-50 kVA 11 kV/400 V station service transformer with 11 kV fuse disconnect -ing switches and necessary outdoor L.T. equipment for three feeders.

(ix) 1 set 110 kV station type lightning arrestors with live line disconnecting clamps and operating pole.

(x) 5 sets - 11 kV pellet type lightning arrestors. ~~5.695~~ 5.372

(b) Other connected works:

(i) Foundations and trenches.

(ii) (ii) Sub-station lighting.

(iii) Sub-station fencing.

(iv) Travelling crane and Gantry.

(v) Transformer truck.

(vi) Transformer track. 1.014

6.386

Total ~~6.709~~

ISB/25.9.

(4) HUBLI RECEIVING STATION;

(a) Outdoor substation consisting of :

(i) Steel structures, mountings, insulators, busbars, etc.

(ii) 2-110 kV. disconnecting switches without grounding blade.

(iii) 1-110 kV disconnecting switch with grounding blade.

(iv) 2 sets 110 kV fuse disconnecting switches for 2 transformers.

(v) 1-2000 kVA 110/kV 33 kV transformer provided with flat rollers (connected).

(vi) 1-5000 kVA 110/11 kV transformer provided with flat rollers (connected).

(vii) 1-5000 kVA, 11/330&11 kV transformer provided with flat rollers (spare). and provided with one set of spares.

(viii) 1-33 kV, 500 MVA outdoor oil circuit breaker with disconnecting switches, meters, instruments and relays.

(ix) 1-11 kV outdoor transformer O.C.B. with disconnecting switches, meters, instruments and relays.

(x) 5-11 kV outdoor feeder O.C.Bs. with disconnecting switches, meters, instruments and relays.

(xi) 4-11 kV outdoor o.c.bs. for 2 synchronous condensers, with disconnecting switches, meters, instruments and relays.

(xii) 2-11 kV, 3000 kVA (leading) synchronous condensers with necessary control equipments, meters, instruments relays and necessary Power cable for connection.

(xiii) 1-33 kV outdoor potential transformer with fuse disconnecting switches.

(xiv) 1-11 kV outdoor potential transformer with fuse disconnecting switches.

(xv) 1-100 kVA 11 KV/400 V station service. transformer with 11 kV fuse disconnecting switches and necessary outdoor L.T, equipment for 3 feeders.

(xvi) 1 set 110 kV station type lightning arrestors.

(xvii) 1 set 33 kV station type lightning arrestors.

(xviii) 5 sets 11 kV pellet type lightning arrestors. Rs. ~~10,000~~ 15·090

604

(b).....

15.090

(b) Other connected works.

(i) foundations and trenches.
(ii) Sub-station outdoor lighting.
(iii) Sub-station fencing.
(iv) Travelling crane and gantry.
(v) Oil filler and testing equipment.
(vi) Oil storage and piping.
(vii) Laboratory equipment.
(viii) Workshop equipment.
(ix) Transformer truck.
(x) Transformer truck.

2.502

Total ~~15.502~~ lakhs

17.592

ISB/25.9.

(5) GADAG SUB-STATION :

(a) Outdoor sub-station consisting of :

(i) Steel structures, mountings insulators, busbars.etc.

(ii) 1- 33 kV disconnecting switch

(iii) 1 -33 kV fuse disconnecting switch for transformer.

(iv) 2 - 2000 kVA 33/11 kV transformers provided with flat rollers one one connected, one spare, and provided with one set of spares.

(v) 1 - 11 kV outdoor transformer O.C.B. with disconnecting switches, instruments, meters & relays.

(vi) 4 - 11 kV outdoor feeder O.C. Bs. with disconnecting switches, meters, instruments and relays.

(vii) 1 - 25 kVA 11 kV/400 V station service transformer with 11 kV fuse disconnecting switches and necessary outdoor L.T. equipment for 3 feeders.

(viii) 1 set - 33 kV station type lightning arrestors.

(ix) 4 sets - 11 kV pellet type lightning arrestors.

(x) 1-11 kV outdoor potential transformer with fuse disconnecting switches. ~~2.761~~ 2.624

(b) Other connected works.

(i) Foundations and trenches.

(ii) Sub-station outdoor lighting.

(iii) Substation fencing.

(iv) Pulley block and gantry. 0.467

Total. Rs. ~~3.228~~ 3.091 lakhs

ISB/25.9.

(6) Dharwar Sub-Station:

	Rs. Lakhs.
(a) Outdoor sub-station consisting of :	
(i) Steel structures, mountings, insulators, bus bars etc.	
(ii) 1 - outdoor 11 kV O.C.B. for incoming line with disconnect -ing switches, meters, instruments and relays.	
(iii) 2 - 11 kV outdoor feeder O.C.B.s with disconnecting switches, meters, instruments and relays.	
(iv) 1 - 11 kV potential transformer with fuse disconnecting switches.	
(v) 1 - 25 kVA, 11 kV/400 V station service transformer with 11 kV fuse disconnecting switches & necessary outdoor L.T.equipment for 3 feeders.	
(vi) 3 sets - 11 kV pellet type lightning arrestors.	~~0.851~~ 0.803
(b) Other connected works:-	
(i) Foundations and trenches.	
(ii) Sub-station outdoor lighting.	
(iii) Sub-station fencing.	0.101
Total	~~0.952~~ 0.904

(7) MANAGAL SUB-STATION.

	Rs. Lakhs.
(a) Outdoor sub-station consisting of :	
(i) Steel structures, mountings, insulators, busbars etc.	
(ii) 4 - Outdoor 11 kV O.C.Bs. 2 for incoming & 2 for outgoing with disconnecting. switches, meters, instruments and relays	
(iii) 1 - 11 kV potential transformer with fuse disconnecting switches.	
(iv)** 4 sets . 11 kV pellet type lightning arrestors.	~~1.159~~ 1.094
(b) Other connected works:-	
(i) Foundations and trenches.	
(ii) Sub-station outdoor lightning.	
(iii) Sub-station fencing.	0.101
Total	~~1.260~~ 1.195

(a)(iv)** 1-25 kVA 11 kV/400 V station service transformer with 11kV fuse disconnecting ~~fuses~~ switches and necessary outdoor L.T.equipment for 3 feeders.

ISB/25.9.

bob

(8) HARIHAR SUB-STATION:

(a) Outdoor sub-station consisting of :

Rs. lakhs.

(i) Steel structures, mountings, insulators, busbars etc.

(ii) 1 - 66 kV outdoor O.C.B. for transformer, with disconnecting switches, meters, instruments and relays.

(iii) 1 - 33 kV Outdoor O.C.B. with disconnecting switches, meters, instruments and relays.

(iv) 2 - 2000 kVA, 66 /33 kV transformers provided with flat rollers one connected and one spare, and provided with one set of spares.

(v) 1 - 33 kV. Potential transformer with fuse disconnecting switches.

(vi) 1 - 48 V battery with trickle charger.

(vii) 1 - 100 kVA 33 kV/400 V station service transformer with 33 kV fuse disconnecting switches and necessary outdoor L.T. equipment for 3 feeders.

(viii) 1 set - 66 kV station type lightning arrestors.

(ix) 1 set - 33 kV station type lightning arrestors.

~~3.589~~
3·379

(b) Other connected works.

(i) Foundations and trenches.

(ii) Sub-station outdoor lighting.

(iii) Substation fencing

(iv) Pulley Block and gantry.

0.773

4·152

Total ~~4.350~~

ISB/25.9.50.

(9) RANIBENNUR SUB-STATION:

(a) Outdoor sub-station consisting of : Rs. lakhs.

(i) Steel structures, mountings, insulators, busbars etc.

(ii) 1 - 33 kV disconnecting switches with grounding blades, for the outgoing line.

(iii) 1 - 33 kV outdoor oil circuit breaker with disconnecting switches, meters, instruments and relays.

(iv) 2 - 1000 kVA 33/11 kV transformers, provided with flat rollers one connected and one spare and provided with one set of spares.

(v) 1 - 11 kV outdoor transformer O.C.B. with disconnecting switches meters, instruments and relays.

(vi) 3 - 11 kV outdoor feeder O.C.Bs with disconnecting switches, meters, instruments and relays.

(vii) 1 - 48 V battery with trickle charger.

(viii) 1-11 kV outdoor potential transformer with fuse disconnecting switches.

(ix) 1 - 25 kVA, 11 kV/400 V station service transformer with 11 kV fuse disconnecting switches and necessary outdoor L.T. equipment for 3 feeders.

(x) 1 set - 33 kV station type lightning arrestors.

(xi) 3 sets - 11 kV pellet type lightning arrestors.

2.462

(b) Other connected works.:-

(i) Foundations and trenches.

(ii) Sub-station outdoor lighting.

(iii) Sub-station fencing.

(iv) Pulley Block and gantry.

0.467

Total: 2.929

ISB/25.9.50.

608

(10) BYADGI SUB-STATION:

(a) Outdoor sub-station consisting of : Rs.lakhs.

(i) Steel structures, mountings, insulators, busbars, etc.

(ii) 1 - 33 kV outdoor O.C.B. with disconnecting switches, meters, instruments and relays.

(iii) 2 - 1000 kVA 33/11 kV transformers provided with flat rollers, one connected and one spare, and provided with one set of spares.

(iv) 1 - 11 kV outdoor transformer O.C.B. with disconnecting switches, meters, instruments and relays,

(v) 3 - 11 kV outdoor feeder O.C.Bs with disconnecting switches, meters, instruments and relays.

(vi) 1 - 48 V battery with trickle charger.

(vii) 1 - 11 kV outdoor potential transformer with fuse disconnecting switches.

(viii) 1 -25 kVA, 11 kV/400 V station service transformer with 11 kV fuse disconnecting switches and necessary outdoor L.T. equipment for 3 feeders.

(ix) 1 set - 33 kV station type lightning arrestors.

(x) 3 sets - 11 kV pellet type lightning arrestors. ~~2.684~~ 2.438

(b) Other connected works:

(i) Foundations and trenches.

(ii) Sub-station outdoor lighting.

(iii) Sub-station fencing.

(iv) Pulley Block and gantry. 0.467

Total. ~~3.051~~ 2.905

ISB/25.9.50.

(11) HAVERI SUB-STATION:

	Rs.lakhs.
(a) Outdoor sub-station consisting of -	
(i) Steel structures, mountings, insulators, busbars etc.	
(ii) 1 - 11 kV outdoor O.C.B. for incoming line with disconnecting switches, meters, instruments and relays.	
(iii) 2 - 11 kV outdoor O.C.Bs. for feeders with disconnecting switches, instruments, meters and relays .	
(iv) 1 - 11 kV potential transformer with fuse disconnecting switches.	
(v) 1 - 25 kVA, 11 kV/400 V station service transformer with 11 kV fuse disconnecting switches and necessary outdoor L.T. equipment for 3 feeders.	
(vi) 3 sets - 11 kV pellet type lightning arrestors.	
	~~0.851~~ 0.803
(b) Other connected works.	
(i) Foundations and trenches.	
(ii) Sub-station outdoor lighting.	
(iii) Sub-station fencing.	0.101
Total	~~0.952~~ 0.904

ISB/25.9.50.

STATEMENT NO.III (b)
(Sheet 4.)

IV Estimate for Civil Engineering Works:

A B S T R A C T

		Rs. Lakhs.
(1)	Sirsi	2.208
(2)	Kavalvad.	1.870
(3)	Dandeli.	1.985
(4)	Hubli	5.537
(5)	Gadag.	1.568
(6)	Dharwar.	0.704
(7)	Hanagal	1.294
(8)	Harihar.	1.410
(9).	Ranibennur.	2.612
(10)	Byadgi	1.458
(11)	Haveri	0.784
(12)	Line Camps.	0.958
		22.468
	Work charged Establishment 2%	0.450
		22.918
	Contingencies 5%	1.146
		24.064
	Establishment, Head office and General Charges 8½%	2.046
		26.110

ISB/25.9.50

IV. Estimate for Civil Engineering Works:

	Rs. Lakhs.
(1) Sirsi:	
(i) Land.	0.064
(ii) Sub-station buildings.	0.343
(iii) Residential Buildings.	1.341
(iv) Lighting, water supply, drainage, Roads, Fencing.	0.460
	2.208
(2) Kavalvad:	
(i) Land.	0.064
(ii) Sub-station Buildings.	0.295
(iii) Residential Buildings.	1.121
(iv) Lighting, water supply etc.	0.390
	1.870
(3) Dandeli:	
(i) Land.	0.064
(ii) Sub-station Buildings.	0.570
(iii) Residential Buildings.	0.991
(iv) Lighting, water supply etc.	0.360
	1.985
(4) Hubli:	
(i) Land.	0.128
(ii) Sub-Station Buildings.	1.340
(iii) Residential Buildings.	2.939
(iv) Lighting, water supply etc.	1.130
	5.537
(5) Gadag:	
(i) Land.	0.048
(ii) Sub-Station Buildings.	0.209
(iii) Residential Buildings.	0.991
(iv) Lighting, water supply etc.	0.320
	1.568
(6) Dharwar:	
(i) Land. ----	

612

[redacted]

(6) Dha-rwar:

(i) Land.	0.032
(ii) Sub-station Buildings.	0.071
(iii) Residential Buildings.	0.511
(iv) Lighting,water supply etc.	0.170
	0.784

(7) Hanagal:

(i) Land.	0.032
(ii) Sub-station buildings.	0.071
(iii) Residential Buildings.	0.916
(iv) Lighting,water supply etc.	0.275
	1.294

(8) Harihar.

(i) Land.	0.048
(ii) Sub-station buildings.	0.161
(iii) Residential Buildings.	0.926
(iv) Lighting,water supply etc.	0.275
	1.410

(9) Ranibennur.

(i) Land.	0.064
(ii) Sub-st tion Buildings.	0.293
(iii) Residential Buildings.	1.695
(iv) Lighting, water supply etc.	0.560
	2.612

(10) Byadgi:

(i) Land.	0.048
(ii) Sub-station Buildings.	0.209
(iii) Residential Buildings.	0.926
(iv) Lighting, water supply etc.	0.275
	1.458

(11) Haveri.

(i) Land.	0.032
(ii) Sub-station Buildings.	0.071
(iii) Residential Buildings.	0.511
(iv) Lighting,water supply , etc.	0.170
	0.784

(12) Line Camp at Siddapur,Siddalgundi and Annigiri.

(i) Land.	0.020
(ii) Residential Buildings.	0.878
(iii) Wells and Fencing.	0.060
	0.958

STATEMENT III (b)
(Sheet 5)

V Estimate for Rural Distribution :

(In Rural Area).

500 kW, to be distributed in Ranibennur, Haveri areas.

500 kW, to be distributed in Hanagal area.

	Rs. lakhs.
Cost of distribution	
Rs. 2400 per kW	24.00
Contingencies 5 %.	1.20
	25.20
Establishment, Head office and	
General charges 8 ½ %	2.21
	27.41

Say Rs. 27.41 lakhs.

ISB/14.10.50.

STATEMENT NO.V.

JOG - KARNATAK ELECTRIC GRID SCHEME:

Calculation of Depreciation.

(According to the provision of the Electricity (Supply) Act 1948).

No.	Item.	Capital cost. Rs. lakhs	90% of the capital cost. Rs.lakhs	Estimated life in years.	Sinking Fund at 3% interest. %	Amount of sinking fund on 90% of the capital cost. Rs. lakhs.
1.	Surveys.	1.38	1.24	50	0.89	0.01
2.	Transport equipment.	2.13	0.12	7	13.06	0.02
3.	Land.	0.75	-	--	-	-
4.	Buildings.	25.36	22.82	50	0.89	0.20
5.	Transmission lines 110 and 33 kV.	71.61	64.45	30	2.10	1.35
6.	Transmission lines 11 kV	10.91	9.82	25	2.74	0.27
7.	Telephone lines.	3.17	2.85	25.	2.74	0.08
8.	Telephone equipment.	1.20	1.08	20	3.72	0.04
9.	Distribution.	22.79	20.51	25	2.74	0.56
10.	Transformers	19.23	17.31	35	1.65	0.29
11.	Switchgear.	43.53	39.18	20	3.72	1.46
12.	Synchronous condensers.	6.02	5.42	35	1.65	0.09
		206.08				4.37

$$\text{Average depreciation} = \frac{4.37}{206.08} \times 100 = 2.12\ \%$$

2 +% is adopted in the financial calculations.

ISB/25.9.50.

Statement No. VIII.
Sheet 1.

JOG KARNATAK ELECTRIC GRID SCHEME.

Calculation of Operation and Maintenance charges:

		Rs. lakhs
1.	Salaries. (as per details enclosed.)	3.35
2.	Waste, Oil, spares and Minor repairs.	1.25
		4.60

Total capital cost = Rs.195.87 lakhs.

$$\text{Average Operation and Maintenance charges} = \frac{4.60}{195.87} \times 100 = 2.35\ \%$$

2.5 % is adopted in the financial calculations.

ISB/25.9.50.

Statement No. VI.

Sheet 2.

STATEMENT SHOWING STAFF SALARIES PER ANNUM.

	Rs. per annum.
Sirsi	27,780
Kavalvad.	22,960
Dandeli	21,180
Hubli	1,11,780
Gadag.	21,180
Dharwar.	8,280
Hanagal	18,540
Harihar.	18,780
Ranibennur.	42,900
Byadgi	19,740
Haveri	8,280
Line Camps.	14,880
	3,34,380

Say Rs. 3.35 lakhs.

ISB/25.9.50.

GOVERNMENT OF BOMBAY.

THE ELECTRIC GRID DEPARTMENT.

TRANSMISSION SECTION

SPECIFICATION NO.T-8/S - 3.

F O R

110 kV. TRANSMISSION LINES

OF THE JOG & KARNATAK ELECTRIC GRID S C H E M E.

MAY 1950

BOMBAY.

HBK/15.IV.50.

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LIST OF DRAWINGS.

1.	No.J 241	Proposed Route of 110 kV.Transmission Lines.
2.	No.J 292	110 kV. Double Circuit Line Towers with single circuit strung.
3.	No.J 293	Guying Arrangement for Towers.
4.	No.J 294	Schematic arrangement of Transposition.
5.	No.J 312	110 kV single circuit line towers with transposition arrangement shown.

HBK/15.IV.50.

INSTRUCTIONS TO TENDERERS:

1. Tenders in duplicate, each complete with all schedules, and tender form duly filled in together with all accompanying tender drawings, descriptive and illustrated literature, etc.,(also in duplicate) must be enclosed in a sealed cover superscribed "Tender against Specification No.T-8/S-3 for 110 kV.Transmission Line of the Jog - Karnatak Electric Grid Scheme", and delivered not later than ..... p.m. on .....1950, direct to the Director General of Industries & Supplies, Shahjahan Road, New Delhi. The stores are required for the Electrical Commissioner with the Government of Bombay.

2. Only such firms need tender as can give satisfactory evidence that they have an Organisation sufficiently experienced to undertake such work to the satisfaction of the Department.

3. In submitting the tenders only schedules attached should be duly filled in and submitted. Complete copies of the specification are not required.

4. If the tenderer has any doubt about the meaning of any portion of the General Conditions of contract of the Electric Grid Department or of this specification, he should at once submit particulars thereof to the Electrical Commissioner with the Government of Bombay, Foreshore Road, Bombay, in writing in order that the doubt may be removed before submission of his tender.

5. Tenders will be opened at the Office of the Director General of Industries and Supplies, Shahjahan Road, New Delhi at 11 a.m. on ..... 1950, in the presence of such of the tenderers as may desire to be present.

6. A single contract would preferably be placed for all the sections covering towers, insulators, conductors, ground cable and guys.

Tenderers are requested to state what rebate they would be prepared to make in their prices in the event of the contract for all the sections being placed with them.

7. The Director General of Industries & Supplies does not bind himself to accept the lowest or any tender.

HBK/15.IV.50.

SPECIFICATION NO.T-8/S-3.

FOR

110 kV TRANSMISSION LINES OF THE JOG-KARNATAK ELECTRIC GRID SCHEME.

Section I - GENERAL:

1. Scope: This specification provides for the manufacture, testing before shipment and delivery, f.o.r. nearest Railway Station of steel towers, insulators, conductors, guys, etc., for a 110 kV double circuit transmission line with one circuit strung or alternatively for a 110 kV single circuit transmission line. from the Mahatma Gandhi Power House at Jog to a Receiving Station at Hubli and a sub-station at Dandeli.

The transmission line totalling approximately 122 miles may be divided into the following sections.

(a) Jog to Kavalvad approximately ... 79 miles.

(b) Kavalvad to Hubli approximately ... 24 miles.

(c) Kavalvad to Dandeli approximately ... 19 miles.

Sections II to VI deal in detail with the materials required.

2. Route: The proposed route of the transmission lines is shown in Drawing No.J/241. The line takes off in a Northern direction from the step-up sub-station of the Power House at Jog and after crossing the Sharavati river immediately, passes through Siddapur, Sirsi & Siddalgundi to Kavalvad, where it branches off, one line towards East going to Hubli and another towards West to Dandeli. There will be a 110 kV. Sub-station at Sirsi, at a distance of about 33 miles from Jog and a switching station at Kavalvad which is about 46 miles beyond Sirsi. The ~~xxxx~~ substations at various places are covered by a separate specification.

3. General Description: Only one three phase circuit insulated for 110,000 volts 3 phase 50 cycles A.C. with the system neutral earthed solidly will be run for the present on ~~xxx~~ lattice steel towers meant for carrying one or two circuits. The conductors used will be A.C.S.R. of 0.1 sq.in. equivalent copper area. The normal span of the towers will be 1050 ~~1000~~ feet with an earth wire on top of 7/9 S.W.G. crapo galvanised stranded steel.

(a) Towers: Three types of towers as described in detail in Section II shall be used for straight runs , angles, and dead or single ends respectively. These towers shall be designed for Double/circuit and shall be suitable for carrying one circuit in Vertical or /configuration for the present on cross arms one below the other/, in triangular contiguration for single circuit and earthwire at the top. Any special towers that may be required will be specified at the time of placing the contract or during the currency of the contract and the contractor shall supply such special towers at the unit rates, which he should quote in his tender.

(b) Insulators: Standard 10" diameter 5½" centre discs seven in number will be used for both suspension and tension strings.

(c) Conductors: Towers will carry three A.C.S.R. conductors of 6 strands 0.186" dia. aluminium +7strands 0.062" dia. of steel (i.e. 0.1 sq.in. equivalent copper area).

(d) Ground Wire: One ground wire of 7/9 SWG crapo galvanised steel will be employed at the top of the towers over the full length of the line.

(e) Guying: Guys of the type shown in drawing No.J/294 will be used exclusively on angle towers on telegraph crossings.

(f) Road, River Railway and telecommunication line crossings

Angle type of towers will be used at Railway, Telegraph and important trunk road and river crossings with double strain strings for Railway and Telegraph crossings and single strain strings for other crossings. For less important road and river crossings, tangent towers will be used, with reduced spans of /~~750~~ ft. At Railway crossings also the above reduced spans will be used. The insulation of the line for the crossing portion over railways will be increased by providing 8 discs in each string of the duplicate tension strings on either side. Where angle type towers other than terminal towers are used for Telecommunication line crossings, they shall be guyed longitudinally away from the crossings as shown in drawing No.J/294

Where power lines cross telephone or telegraph communicatio circuits, guard cradles will be provided over the latter on separate poles. But this will be arranged for departmentally in consultation with the Telegraph authorities.

(g) Transposition: Each power conductor will be transposed approximately once in every 7 to 8 miles giving five complete barrels of Transposition in the line. The transposition arrangement is shown in drawing No.J/ 293 for double circuit lines in drawing No.J.312 for single circuit line.

(h) Telephone Line: For the efficient operation and maintenance of the transmission lines and substations, a telephone line on separate poles will be erected. It will run parallel to the power line at a normal distance of 600 ft. and minimum distance of 400 feet from it. This will be arranged for by the purchaser.

4. Temperature: For overhead conductors carrying current and exposed to the sun the temperature is expected to vary from 40°F to 140°F.

5. Altitude: Along the route of the Transmission line, the altitude is normally about 1500 to 2000 feet.

6. Wind Pressure: The following wind pressures shall be adopted in the line designs:

(i) Wind pressure on conductors - 15 lb. per square foot on two-thirds projected area.

(ii) Wind pressure on towers - 25 lbs. per square foot on 1½ times the exposed area of one face.

7. General conditions of contracts: All works covered by this specification shall be carried out in accordance with the "General Conditions of Contract for Plant, Machinery and Manufactured Equipment."

Where the conditions of tendering or directions to the tenderer described herein conflict with those specified in the "General Conditions of Contract for Plant and Machinery and Manufactured Equipment", the former shall be binding in preference to the latter.

8. Payments:- Payments will be made in accordance with clause 25 of the "General Conditions". No payment will be made for materials damaged or broken during transit. Bills will not be passed until test certificates are received and approved.

The nearest Railway Stations for purposes of payments under (b)(i) of clause 25 of the "General Conditions" shall be

Hubli, Dandeli, Haveri, Talaguppa and any other stations approved by the purchaser.

For conductors, payments will be made on the basis of actual length ordered and supplied.

9. Completeness of tender:- The tender should be complete and include all minor accessories which may not have been specifically mentioned in the specification, schedules, etc., but are essential for completeness of the work. The contractors shall not be eligibl for any extra in respect of such minor accessories, even though not specifically included in the tender or contract schedules.

10. Departure from specification: The designs of the towers etc. shown in specification drawing may be modified by the tenderer at his discretion provided the requisite factors of safety and clearances are maintained.

If the tenderer wishes to depart from the specification in any respect, he shall draw attention to such points of departure explaining fully the reasons therefor, so that the relative merits of proposals may be considered. Unless this is done, the requirements of the specification will hold good.

11. Drawings:- The tenderer shall submit with this tender dimensioned drawings of the general arrangements of towers ,insulators joints, clamps, etc.

The contract drawings referred to in clause 4 of the "General Conditions" shall be submitted within four months after awarding the contract.

Of the three sets of final drawings, one set should be in ink on tracing cloth, while the other two sets may be prints mounted on cloth.

Any approval which the purchaser may have given to the detailed drawings submitted by the contractor will not relieve the latter of his responsibility for the correctness of design and for the execution of the contract in accordance with the terms of the specifications.

12. Materials and Workmanship: Unless otherwise specified all materials shall be of the outdoor type, of the best class and capable of satisfactory operation when exposed to the tropical Sun, atmospheric conditions and heavy rainfall. Unless otherwise specified, they shall conform to the requirements of the appropriate pre-war current British Standard Specifications or equivalent American Standards. No materials shall be erected unless previously passed by the Engineer.

13. Tests: The contractor shall furnish in duplicate manufacturers' test certificate in respect of all materials.

In addition to the tests called for in this specification, the purchaser reserves the right of having such tests as he desires to be carried out at his own expense to satisfy himself that the materials conform to the requirements of the specification.

14. Electricity Rules: All work shall be carried out in accordance with the Indian Electricity Act & Rules, unless modified by this specification.

15. Tools and spare parts: The tenderer is requested to fill in Schedule "B" such tools and spare parts as he recommends for two years' operation. The purchaser may order such of the quantities as he may finally decide upon, at the rates quoted under Schedule "B".

16. Prices: The prices quoted for the materials should be in firm Rupees and independent of exchange variation or fluctuation in prices of materials.

If the tenderer is unable to quote a firm price in respect of any particular item or items, he should endeavour to give a firm price which would hold good for at leat three months from the announced date of receipt of tenders. On a acceptance within this period, the price will be taken as absolutely firm for the contract and entered as such in the contract documents.

Customs, import and other dues, if any, should be included in the prices.

The quantities mentioned in the accompanying schedules are

only very approximate. The purchaser reserves the right of revising the quantities at the time of placing the contract and of ordering more materials during the contract at the accepted rates.

For any class of materials for which rates are not available in the contract schedule payments will be made on the basis of actual cost plus 5 per cent. But this will not apply to the minor accessories referred to in clause 9 above.

Actual cost shall mean the actual cost of materials and labour including petty supervision, but not charges of higher staff, paid on a monthly or contract basis.

17. Interchangeability:- All similar materials and removable parts of similar equipments shall be interchangeable with each other.

18. Delivery: Early delivery is essential and will be an important consideration in awarding the contract. The guaranteed period-s of delivery should be clearly stated.

19. Penalty: Special attention is drawn to clause 32 of the "General Conditions of Contracts for Plant, Machinery and manufactured Equipment.".

20. Inspection: A representative of the purchaser shall have access to contractor's or sub-contractor's Works at any time during working hours for the purpose of inspecting the manufacture and testing of the materials covered by the contract. The contrac-tor or sub-contractor shall provide facilities for the necessary inspection.

21. Programme: The programme of work should be forwarded to the purchaser for approval.

SECTION II - TOWERS.

22. Scope: This section covers the manufacture, testing before shipment and delivery f.o.r. nearest railway station of steel towers and accessories specified in detail below.

23. Types of Tower: (a) Three types of tower will be used and designated as under:

Item No.	Description.	Designation of single or Double circuit towers with A.C.S.R. conductors.
1.	Tangent towers for straight runs and angles upto 2° with normal spans 1050 feet.	A
2.	Angle towers for angles upto 30° and normal spans of 1050 feet. Also longer spans and smaller angles.	B
3.	Anchor Towers for dead ends and large angles upto 60° with normal spans of 1050 ft. also for longer spans and smaller angles.	C.

(b) Tangent Towers - Type A:- These towers for use on straight runs with normal spans of 1050 ft. The use of these towers will be limited to 2° angles with suspension strings. In the case of less important road and river crossings tangent towers will be used with reduced spans.

(c) Angle Towers - Type B: These shall also be used with double strain strings at Railway and Telegraph crossings and single strain strings at important trunk road, and river crossings

(d) Anchor Towers - Type C: These towers shall also be used for extra long spans, but as far as possible long spans and large angles will be avoided.

(e) Crossarms:- The crossarms shall generally be as shown in drawing No.J/ 292/ in case of double circuit towers and as shown in * J/312 in case of single circuit towers, unless tenderer wishes to modify them The use of normal crossarms will be restricted to normal spans and special crossarms will be used above this span.

(f) General:- The three types of Tower will have the general design dimensions shown on drawing No.J/ 292 or J/312 But the designs may be altered at the discretion of the tenderer if he can put forward better and more economical types.

The towers shall be designed so as to be suitable for adding 10 feet extensions at the base without reducing the specified factor of safety in any manner. Some extensions will be needed where ground clearances are found to be inadequate. Separate unit prices for 10 feet extensions should be given for each type of tower. The footings shall if possible be suitable for towers with or without extensions.

The tenderer must clearly specify in his tender the means provided in his design for transferring the side thrust to earth.

All towers shall be of galvanised steel sections bolted together with bolts and nuts.

24. Transposition: Standard Angle towers of type B will be used with crossarms modified and adjacent spans reduced to 750 feet. The arrangement is as indicated in drawing No.J/293 The tenderer should check and see if adequate clearances between wires under wind conditions are obtained. If not, he is requested to put forward his proposal. This is applicable only to D/C towers. The transposition in the case of S/C will be made on the A type towers as * as shown in rawing J/312

The tenderer is at liberty to offer any other type of design in line with modern practice but must provide the necessary clearance specified in clause 34 below.

The jumper connections on towers having special transposition cross arms should be of sufficient section to make them quite stiff. The arrangement is indicated in Drawing No.J/293

25. Foundations: All tangent, angle and anchor towers will have concrete foundations. In very loose or marshy soil, special concrete foundations shall be provided to suit actual conditions. Full particulars of foundations for the three types of towers shall be given in the tender. For footings it can be assumed that the earth weighs 90 lbs. per cubic foot and that the base of the footing will engage the frustrum of an inverted pyramid whose sides make an angle of 30° with the vertical. The weight of the concrete may be taken as 125 lb. per cubic foot.

All the four stubs of the towers should be similar irrespective of compression or uplift.

When towers stand on solid rock, suitable holes shall be

drilled and grouted with cement or cement concrete. The tower stubs for rock foundations may be shorter than those for the concrete type. The recommended depth should be specified as also the size of the holes to be drilled.

Templates for setting the tower must be provided with tower materials.

26. Special structures: In addition to the standard towers specified above, special structures shall, if required for river crossings, be supplied by the contractor. The tenderer is requested to fill in unit rates per ton of superstructure and footings for such towers.

27. Loadings and factor of safety:- The towers shall be designed for the maximum conditions of loadings given in Table III and shall be able to withstand a test load equivalent to the maximum specified working load multiplied by the corresponding factor of safety without any injury or permanent deflection.

The factor of safety shall not be less than the figures given in Table II for all towers and crossarms namely, 2½ under normal conditions and 1½ under broken wire conditions. The factors of safety against overturning shall also be the same as above. For determining the bearing area of footings, the safe working bearing pressureunder normal and broken wire conditions shall not exceed 1 ton and 1.67 tons per square foot, respectively. These values are based on an ultimate pressure of 2½ tons per square foot.

28. Stresses: The values of the undernoted maximum unit stressed employed for the purpose of the design for-

(a) normal working conditions, and (b) broken wire conditions should clearly be specified in the tender:-

(i) Tension in lb. per squqre inch of net section:-

(ii) Compression in lb. per squre inch of gross section-

(a) for ratio of slenderness less than 150, and

(b) for ratio of slenderness greater than 150;

(iii) Shearing stress on bolts in lb. per square inch.

(iv) bearing stress on bolts in lb.per squrne inch.

The formula adopted for determining the crippling stress of members should be stated and stress diagrams and tables showing the permissible and actual loadings furnished in the tender.

Details of design calculations should also be furnished in the tender.

29. Ratio of slenderness:- The ratio of slenderness l/r of a member is its unsupported length divided by its least radius of gyration and shall not exceed 140 for leg members and 200 for the members having calculated stress and 250 for members having only nominal stress.

30. Erection stresses:- Where erection stresses combined with other permissibly co-existent stresses could produce a working stress in any member, appreciably greater than the specified working stress, such additional material shall be added to the member or such other provision made as is necessary to bring the working stress within the specified limit.

31. Guying:- Guys will be used exclusively on angle towers used for telegraph crossings as per drawing No.J/294 Provision shall be made on those towers for attachment of the guys as per drawing.

32. Grounding: In order to provide for efficient grounding in cases where the iron work is completely encased in concrete, unit rates may be quoted for 1" galvanised iron pipe and 0.1 square inch tinned copper tape.

33. Insulator attachment and ground wire clamps:- For the attachment of suspension strings 5/8" U-bolt is suggested, the plane of the U-bolt lying longitudinally. The total length of suspension strings shall not, if possible, exceed 4 ft.6 in.. But this is subject to modification depending upon the recommendations of the tenderer.

For strain insulators, a strain plate of suitable dimensions on the underside of the crossarms is proposed.

The design of the insulator attachments shall be suitable for the standard crossarms without any modifications. Full details should be given in the tender drawings.

For the ground cable, suitable suspension and tension clamps should be provided on the suspension and strain towers respectively. The ground wire should be suitably bonded to the tower to ensure good electrical connections.

34. Clearance of live parts to crossarms and towers:-

The following minimum clearance should be provided between live parts and earthed tower or crossarm members:-

	Inches:
(i) Suspension strings in still air and when deflected by wind by 10^{o} from the vertical.	48
(ii) Suspension strings when deflected by wind by 45^{o} from the vertical.	42
(iii) Strain strings at strain towers.	48.
(iv) Jumper connections at strain towers when deflected by wind upto 10^{o} from vertical.	48
(v) Jumper connections at strain towers when deflected by $22\frac{1}{2}^{o}$ from the vertical.	42

The standard suspension and tension strings will have arcing horns on the line side but none on the crossarm side. The clearances should be reckoned from the extreme edges of the hardware.

Where necessary the jumpers may be weighted to give the necessary clearance under wind conditions.

The contractor shall submit the clearance drawings for the towers with suspension, single and double tension strings.

35. Material: All steel employed for the tower members shall be open-hearth steel with a high yield point and high ultimate tensile strength, and in accordance with the manufacturer's standard specification which must be submitted in full detail with the tender. Permissible variation in weights from calculated weights shall be strictly in accordance with the provisions of the pre-war current edition of British Engineering Standard specification No.15.

The tenderer must state the names of makers from whom he proposes to obtain materials for the fabrication of the towers. The contractor shall not obtain any materials for the purpose of contract from makers other than these stated in the tender and approved by the purchaser, without written permission of the purchaser.

36. Minimum thickness: No steel section shall be less than ¼" in thickness if used for leg members or 3/16" if used for other members.

37. Number of Parts: Tower structures shall be constructed to bolt together easily on the site and preference will be given to the design with the least number of parts and the one with best facilities for transport, erection and cleaning. In designing towers for a minimum number of parts the tenderer should not, however, employ parts of such dimensions as would prove difficult to handle. The length of the longest piece should not, if possible exceed 20 ft.

38. Bolts, nuts and washers: All bolts and nuts shall be of mild steel of the quality specified in the pre-war current British Engineering Standard Specification No.153, the heads being forged out of the solid, truly concentric and square with the shank which must be perfectly straight. All bolts should be threaded with British Whitworth or American or other approved standard threads to take the full depth of the nut and shall be threaded far enough to permit firm gripping of the member but no farther. All nuts shall be hand-tight to the bolts. No appreciable fillet shall exist at the point where the shank of the bolt connects to the head. Steel and wrought iron tapered washers shall be provided wherever necessary.

Lock washers shall be provided for insertion under all nuts. These lock washers shall be of steel, of the "positive lock" type and about 1/8" in thickness.

Ten per cent excess bolts, nuts, tapered and lock washers shall be provided. The tenderer must give a specification as to the size of bolts, size of holes, and any other special details of this character, but no bolts less than 5/8" diameter nor any angle through which a bolt passes having a leg less than 1 ¾" shall be used.

39. Drilling and punching: Holes may be drilled or punched but drilled holes will be preferred. The tenderer must state clearly the extent of punching covered by his tender. All burrs left by drill or punch shall be removed completely. Diameters of bolt-

holes shall be no more than 1/16" larger than the diameter of the bolt.

40. Splices: Where a lap splice is used in leg members the back of the inside angle shall be chamfered, to clear the fillet of the out side angle.

41. Ladders: Each tower shall be provided on one of the legs with step bolts of not less than 5/8 inch diameter 6 inches long, spaced not more than 18 inches apart and extending from about 8 feet above the ground level to the top of the tower. Each step bolt shall be provided with two nuts on one end to fasten the bolt securely to the tower and a buttom head at the other end to prevent the foot from slipping and shall be capable of withstanding a vertical load of not less than 300 pounds.

42. Danger number and phase plates, Birdguards and anti-climbing devices:

Each tower shall be drilled with holes in a suitable position on one side face for fixing the combined danger and number plates and separate phase plates which will be provided by the contractor/if considered necessary by the purchaser. For these also unit rates may be quoted for supply - Approximate quantities of the above materials required are indicated in the schedule.

devises will be provided by the contractor

Unit rates for approved designs shall be quoted by the contractor. Anti-climbing

Approved type of birdguards shall be provided on each cross-arm on all locations. Cone type birdgudrds would be preferred. The contractor shall quote unit rates for the same.

43. Galvanising: All galvanised members of the towers shall be galvanised after fabrication by the hot-dipping method and bolts and other special parts shall be either sherar-dised or, preferably, hot-dip galvanised. Galvanization may be omitted upon the threaded portion of the nut. Threads of nuts and bolts shall be so made that, after galvanizing or sherandizing the nuts will have a neat fit and can be turned with the fingers throughout the length of the thread of the bolt and they shall be capable of developing the full strength of the bolt.

All hot-dip galvanized or sheradized materials shall satisfactorily withstand the tests of specification No.D.210-22 of the

Metro

National Electric Light Association (United States of America) for hot galvanizing (copy in appendix I herewith).

44. Steel work in concrete:- All steel work embedded in concrete shall not be galvanised or coated with any paint. One shop coat of linseed oil would be sufficient, and the same should be removed at site, before embedding the steel in concrete.

45. Assembling: Towers including anchorages may be shipped entirely knocked down or built in sections and members marked properly for bolting together in the field.

46. Workmanship: Workmanship and finish shall correspond to the best modern transmission line practice. All similar parts shall be made strictly inter-changeable. All plate sections and bars, before any work is done on them shall be carefully levelled, straightened and made true by methods which will not injure the materials, so that when assembled, the adjacent surfaces are in close contact throughout, No rough edges will be permitted anywhere throughout the work.

47. Guarantees:- Any defects of workmanship or material appearing within the maintenance period specified in clause 36(amended) of the "General Conditions" herewith shall be made good by the contractor f.o.r. nearest railway station.

48. Drawings:- The tenderer shall submit with his tender dimensioned general arrangement drawings for each type of structure, showing sizes of all sections, parts, fittings, bolts, attachments for insulators, ground wires, guys etc., together with corresponding calculations, stress diagrams and complete clearance diagrams.

The contractor shall submit within four months of the placing of the order the contract drawings referred to in clause 4 of the "General Conditions", which shall include drawings showing the final design in detail, the calculation of stresses for the various members and graphs showing the relationship between (a) the angle of deviation and (b) the maximum sum of adjacent spans for each type of tower.

On all drawings submitted by the contractor there shall

appear the name of the structure for which the material is intende

The contractor shall furnish itemized list of the maximum stresses on each member in accordance with this specification, and the calculated weight of each item of material for every part of the structure. This may be incorporated either in the detailed drawings or made in the form of a separate shipping list.

The contractor shall also supply on tracing cloth, dimension -ed erection and assembly drawings for each type of structure, bearing the same marking for each member as given in the material lists. These drawings shall be supplied to the purchaser before th final testing of the assembled structure referred to in clause 51 i in order that the purchaser's representative can check them with the assembled structure.

49. Marking: All pieces shall be distinctly marked with erection marks corresponding to these in the drawings. Steel stamping dyes 3/4 inch in height shall be used in addition to the paint marks and special care shall be taken to see that all erection marks be made in such a manner as not to be obliterated in transit or in any way damage the galvanizing.

In addition to numerals, shipping marks shall include prefix letter A, B or C for the tangent, angle and anchor towers respectively. Similarly shipping marks for extensions and any other special structures shall include prefix letters to be previously approved by the purchaser.

50. Inspection: A representative of the purchaser shall have access to the contractor's or sub-contractor's works at any time during working hours for the purpose of inspecting the manufacture of the towers and/may select test samples from the material going into the towers. The contractor or sub-contractor shall furnish facilities for testing such samples at any time.

51. Tests at contractor's premises:- One specimen tower of each type shall be fabricated by the contractor as soon as possible upon the placing of the contract and before starting on the fabrication of the towers ordered. It shall be assembled on

foundations as near as practicable to that used in the field and tested with a suitable test load as may be agreed upon, equivalent to the stresses specified in clause 27, multiplied by the corresponding factors of safety, to ensure that the design complies with the requirements of the clause. Each structure shall be capable of withstanding the above test-load without injury or permanent deflection of any of its parts, and if any member is found weak or damaged, the design shall be suitably modified and the tower retested.

After the first lot of towers have been fabricated, the members forming one tower of each type shall be selected at random from lots of similar members and assembled and bolted together in exactly the same manner as specified for towers at site. The tower shall then be set on a foundation as nearly similar as practicable to that to be used in the field and tested with loads equivalent to these for which the tower is designed, multiplied by the corresponding factors of safety.

If desired by the purchaser such towers shall be tested to destruction at the expense of the purchaser by the contractor and under the general direction of the purchaser with the suitable test-loads as may be agreed upon.

The tender price shall include the cost of carrying out all the above specified tests, except the test to destruction, for which an extra price must be quoted for each type of tower.

No tower (or any member thereof) which failed under test should be railed to site.

No tests need be carried out on the 10 feet extension or special structures but they should be carefully designed and fabricated to give the requisite factor of safety.

52. Packing:- Except in the case of towers to be delivered in sections, all the above materials shall be boxed or bundled, and transported in the following manner.

(a) Beams, channels and angles shall be transported

in bundles of two or more securely wrapped four times around at each and every three feet with No.9 gauge steel wire with ends twisted tightly. Cross weight of each bundle shall not exceed approximately 1,000 lbs. and the length of any individual member 20 feet.

(b) Clip angles, brackets, fillet plates and similar small loose pieces shall be nested bolted together in multiples or securely wired together through holes, wrapped round at least four times with No.9 gauge wire, and ends twisted tightly. Gross weight of any bundle shall not exceed approximately 150 lb.

(c) Bolts, nuts and washers. The correct number of bolts, nuts and washers plus 10 per cent. excess for each tower, extension, crossarm set, attachments to crossarms, and earth anchor set, to be packed in heavy burlap bags accurately tagged in accordance with the contents and a number of bags packed in a solid box of 7/8 inch lumber with panelled ends to be securely nailed and further reinforced with 7/8 inch by 3 inches battens around the sides at the ends; with 1 inch by No.18 gauge iron stretched entirely around the battens with ends lapping at least 6 inches. Gross weight of each box shall not exceed approximately 150 lb.

All packing shall be subject to the approval of the purchaser or his appointed representatives.

(d) Each package shall be marked "Jog - Karnatak 110 kV Line Towers".

SECTION III - INSULATORS.

53. Scope :- This section covers the manufacture, testing before shipment and delivery f.o.r. nearest railway station of insulators and accessories required for the 110 kV transmission line and described in detail below.

54. Type of Insulators :- Suspension and strain type insulator strings consisting of standard 10 - inch discs with 5½" c/c centres of the Cap and Pin, Ball and Socket type will be used. The tenderer is at liberty to offer any other suitable type, but should state reasons for his preference. The colour of the Units shall be brown.

Double tension strings will be used at railway and telegraph crossings, and single tension strings at important trunk road and river crossings with angle towers in both cases. Suspension strings will be used up to deviation of 2^{o} in the transmission line and strain insulators above this angle. The strain insulators, for B. & BT type towers will be provided with 12" links and those of C type with 21" links in order to provide sufficient time to earth metal clearance. Seven units will be used both in suspension and tension, and eight units on the duplicate tension strings used for Railway crossings. Where double tension strings are used, the spans will be reduced to 750 feet . The insulator equipment for special river crossings shall be designed separately, if so required by the purchaser.

55. Hardware:- Each insulator string shall be supplied complete in every respect and include :-

(a) Clamps for attaching it to the U-bolt or strain plate supplied along with the towers;

(b) Clamp for attaching the conductor to the string and suitably lined to prevent damage of the conductor;

(c) Suitable fittings of ball and socket type for interconnecting units and to the top and bottom clamps;

(d) links with suitable fittings for the strain insulators as described in para 54 above.

(e) Arcing horn .. ...

(e) Arcing horn on the line side of suspension and tension strings; and

(f) two and a half per cent. extra bolts, nuts, copper-pin, etc.

The contractor shall be responsible for satisfying himself that the fittings are entirely suitable for the towers and conductors.

In the case of double strain strings, the hardware shall also include suitable yoke equipments.

All fittings shall be made of forged steel or malleable iron and shall be hot dip galvanised after all machining and fitting have been completed in accordance with the requirements of specification No.D.210/22 of the National Electric Light Association for hot galvanizing (copy in Appendix I herewith) or treated in other approved methods to prevent corrosion.

All bolts, nuts and screw-threads should be as far as possible of the same standard thread (either Whitworth or American or other approved standard) throughout, bolts and nuts having hexagonal heads and, where required, the nuts shall be locked in an approved manner. All bolts and nuts shall be hot dip galvanized including the threaded portions of the bolt with the exception of the nut threads which shall be oiled.

56. Special spark gaps near substation ends:- It is proposed to reduce the line insulation near the substation ends over a length of about 3/4 mile on either side in order to prevent steep wave fronts from reaching the substation equipment. Special adjustable spark horns are proposed to be fitted to the crossarm and line sides of the insulator strings for the distance specified above. The sparkgap should be so spaced as to ensure effective operation under actual conditions. The range of settings of the above equipment and the dry, wet and impulse, flash over values should be given.

The tenderer is requested to quote a separate price for the special horns. The tenderer should submit drawings showing the arrangement and method of preventing the arcing horns from relative displacement between each other and also between the insulator discs and the arcing horns.

57. Quality :

57. Quality:- The quality of porcelain and hardware and all workmanship should be of the highest grade and such as is suitable and customary for high tension lines.

Any defect of material or workmanship discovered within TWO YEARS after delivery at site and due to the contractor, shall be replaced by him free of charge, f.o.r. nearest railway station in accordance with clause 36 of the "General Conditions."

58. Clamps: The clamps shall be suitable for the conductors when protected by arm or rods or wrapped in aluminium tape as required. The A.C.S.R. conductors shall be fitted with anti-vibration device or with arm or rods as recommended by the contractor for the conductors. The design of the suspension clamps must be such as to avoid all hard spots or kinks which * which are likely to injure the conductor. The suspension clamps shall preferably be of the trunnion type with at least 2 U-bolts. The tension clamps shall be of the snail type or compression type.

59. Mechanical strength of insulator strings and clamps:-

The breaking load of suspension and tension clamps, of complete strings, and of all component parts shall not be less than 12,000 lb. The electromechanical strength of individual units as also of the complete string should not be less than the above value.

The slipping strengths of the suspension and tension clamps shall be suitable for use with the line conductors, and should be clearly stated in the tender.

60. Electrical Characteristics:- Full guaranteed particulars including wet and dry flashovers, puncture and impulse voltages, corona formation voltage, creepage length, voltage distribution on strings, etc. should be given in the tender. The dry and wet flashover values of strings fitted with standard arcing horns at sea level and at 80° F and 80 % relative humidity should not be less than 290 kV and 250 kV respectively (Rms. values and there should be no cascading).

61. Leng th of strings and clearance of live parts to tower members:- In the case of suspension strings a maximum length of 4 feet 6 inches has been assumed in specifying clearance to tower members.

But this is subject to modification depending upon the actual insulators approved.

62. Inspection:- The purchaser's representative shall have access to the manufacture's works for purposes of inspection in accordance with clause 15 of the "General conditions."

63. Drawings: The tender shall be accompanied by detailed drawings showing the dimensions of the complete strings including arcing horns and the design and dimensions of various parts and clearly show the method of cementing the porcelain to the metal caps and pins. Full particulars of the conductor clamps must be given and the nature of the materials used for the various parts clearly. Specified either on the drawing or in a separate statement.

64. Tests: Suitable numbers of individual units and complete strings shall be subjected to the following tests in accordance with 'Insulator Test Specification A.I.E.E. standard No.41, (1944) published by the American Institute of Electrical Engineers".:-

(a) Electrical Tests:

4.1 - Low frequency dry flashover Test.

4.2 - Low frequency Wet flashover Test.

4.3 - Impulse flashover Test.

4.4 - Impulse Withstand Voltage Test.

4.6 - Corona Test.

4.7 - Puncture Test.

(b) Mechanical Tests:

5.1 - Mechanical Strength Test.

5.2 - Combined Mechanical & Electrical Strength Test.

5.3 - Poresity Test.

5.5 - Thermal Test.

(c) Routine Tests.

7.1.1 - High frequency Test.

7.1.2 - Low Frequency Test.

7.1.3 - Over voltage Test.

7.2 - Routine Mechanical Tests.

The following tests shall also be carried out at the

works:-

(a) Breaking load test on complete string.

(b) Test for slipping strength of suspension and strain clamps.

(c) Galvanizing test in accordance with N.E.L.A. standard specification No.D.210-22(Copy in Appendix I herewith).

(d) Assembly test to ensure that all cotter pins, bolts, clamps etc.,fit freely and properly.

Note:- In the case of test after assembly specified in AII.E.E. standard 7.1,1, 7.1.2, & 7.1.3, 50 per cent of the insulators shall be subjected to "high frequency test" and the other 50 per cent to "over-voltage test" as specified in 7.1.3 thereunder.

A separate price should be quoted for impulse tests on one string of each type.

The tenderer must clearly state what testing facilities there are, in his laberatories or other laberatories where he proposes to carry out the tests.

65. Glazing :- Glazing shall be uniform and free from defects.

66. Marking : Every insulator unit must have impressed on it, before firing under the glaze and legible after glazing, the name, initials or trade mark of the manufacturer as well as the year of manufacture.

67. Interchangeability:- The insulators together with the ball and socket fitting shall be of standard design, so that the insulators may permit of being interconnected with all similar standard types common to British,Canadian and United States manufactures.

68. Packing: All insulators shall be packed in crates or boxes suitable for rough handling. Particulars of packing shall be given in the tender. Each package shall be marked "Jog Karnatak 110 kV Line insulators.".

SECTION IV - Power Conductors.

69. Scope :- This section covers manufacture; testing before shipment and delivery f.o.r. nearest railway station of A.C.S.R. conductors, complete with joints , clamps and other accessories.

70. A.C.S.R.Conductors:- The A.C.S.R. conductors shall comprise of 6 strands of 0.186" dia. Aluminium laid on a crapo galvanised steel stranded wire of seven strands of 0.062" dias and shall comply in all respects with B.S.S. No.215 of 1934. The steel core shall be protected by compound before application of Aluminum strands.

71. Joints and jointing tools:- Any type of joint in line with manufacturers' standard practice and which must have given satisfactory service elsewhere in India, over a number of years, may be offered but the joints shall have the same conductivity as the conductor and a mechanical strength not less than that of the conductor. Compression joints for A.C.S.R. conductors will be preferred. Suitable number of joints and jointing tools should be tendered for and their full particulars and drawing included in the tender.

72. Comealongs and dynamometers for stringing conductors:- Suitable automatic and Bolted type come-along clamps and dynamometers should be included. The slipping strength should be specified in the tender but it should not be less than 3000 lbs.

73. Vibration dampers: The tenderer should examine the need for vibration dampers and include suitable type of damper if considered necessary. A separate price for these should be given.

74. Jumper Clamps at strain towers:- Parallel groove or other suitable clamps having the same conductivity as the conductor and a minimum of 4 bolt grip shall be supplied for making jumper connections at strain towers.

75. Inspection:- The purchaser's respresentative shall have access to the manufacturer's works for purposes of inspection in accordance with clause 15 of "General Conditions".

76. Tests:- Individual wires and finished cables shall be subjected to the following tests:-

(i) All tests specified in B.S.S. No. 215 of 1934 and the following -

following:-

(ii) Wrapping test :- Samples of aluminium wire before stran-ding shall be closely wrapped six times round wires of their own diameter, unwrapped and again wrapped closely six times round wire of their own diameter in the same direction as the first wrapping, without breaking. The steel core shall also be subject to the same test except that the wrapping will be done on a round bar of five times the diameter of the wire.

(iii) Twisting test:- Samples of aluminium and steel wire shall be gripped in two vices, one of which will be made to rotate at a speed not exceeding one revolution per second. The number of complete twists before breaking shall not be less than that guaranteed by the tenderer.

(iv) Galvanizing tests for steel wire: Samples of steel wire shall be twisted round wire or round bar of two and a half times its own diameter and untwisted without showing signs of flaking or pealing of the galvanised coating.

77. Stringing of conductors and factor of safety:- The conductors shall be strung with a minimum factor of safety of 2.5. The contractor should clearly specify the methods of stringing and submit with the tender stringing charts showing tension and sags for various temperatures and spans.

78. Packing :- All packages must be marked "Jog-Karnatak 110 kV line power conductor". The length and weight in each drum should be clearly stated.

...

SECTION V - Ground Cable

79. Scope :- This section covers the manufacture, testing before shipment and delivery f.o.r. nearest railway station of the ground cable for the transmission line.

80. Details of Cable:- The cable shall consist of stranded galvanised Siemens Martin Steel Wires, and shall have the following particulars :-

(i) Size of ground cable - 7/9 SWG
(ii) Overall diameter - 0.432"
(iii) Approximate tensile strength 9840 lbs.

The cable may be supplied in manufacturers standard lengths. The length* and wight per drum should be clearly stated in the tender.

81. Joints and jointing tools :- Any type of joint, in line with manufacturer's standard practice may be offered but the joints shall have a strength not less than that of the conductor. Suitable number of joints and jointing tools shall be provided and their full particulars and drawing included in the tender.

82. Attachment to power:- At all suspension towers the ground wire shall be suspended by a suitable suspension clamp and officiently bonded to the tower. On strain towers, tension clamps shall be provided at the top of the tower as shown in specification drawings. Both types of clamps as also the necessary jumper clamps at strain towers shall be included under this section.

83. Stringing:- The conductor shall be strung with a minimum factor of safety 2.5 . The actual factor of safety shall be so chosen that the earth wire will be nearly parallel to the power conductors over the whole length of the span. Stringing charts shall be submitted with the tender by the contractor and shall indicate the method of stringing proposed by him.

84. Tests:- Suitable number of samples of individual wires and finished cable shall be subjected before shipment to tests as specified in B.S.S. No. 183 of 1938- Rejections will be made in accordance with clause 11 therein.

85. Packing:- All packages must be marked "Jog Karnatak 110 kV line Ground Cables". The length and weight in each drum should be clearly stated.

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SECTION VI - Guying Materials.

86. Scope:- This section covers the manufacture testing before shipment and delivery f.o.r. nearest Railway station of guying materials for the above transmission lines.

87. Description :- The following materials included herein are shown on drawing No.J.294 by their respective item numbers

Item 1: 5/8" inch eye bolts each 6 in. long from the centre of the eye to the end of the bolt-complete with nuts and spring washers suitable for gripping tower angle iron members.

Item 2: Forged steel turn-buckles ¾ inch diameter 9 inches long, with eye on both ends.

Item 3: Open end guy thimble for taking 7/9 SWG steel stay wire.

Item 4: Guy clamps each complete with three bolts and nuts for clamping the guy wire specified under item 7below.

Item 5: 3/4" anchor rods each eight feet long complete with square washer and nut.

Item 6: Anchor log. This may be a 75 lb, rail six feet long.

Item 7: One inch wedge bolts each 18 inches long, with 1 3/8" eyes for anchoring guys in natural rock.

Item 8: Crape galvanised steel guy cable consisting of seven strands of No. 9 SWG with an ultimate strength of not less than 6000 lbs.

All materials except item 6 shall be hot dip galvanised to comply with the requirements of the National Electric Light Association as given in their "Overhead Systems Reference Book". (Steel- Specification No. D.200-22 on page 519, Bolts and Nuts - Specification No. D.209-22 on page 520, and ~~Exikx~~ Hot galvanising Specification No. 210-22 on page 521.)

They guy cable under item 8 shall comply with the requirements of British Standard Specification No.183 of 1938 and the rest of the items with requirements of the National Electric Light Association.

88. Tests: Before dispatch a suitable number of samples shall be tested in accordance with the respective specifications.

89- Packing :- All packages must be marked "Jog-Karnatak 110 kV Line Guying Materials".

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TABLE I.

Mechanical characteristics of the 110 kV - Transmission Line. Conductor, ground wire and Insulators. (Double or Single circuit tower alternatives)

Item No. and Description	:	DATA.	
1. Approximate length of the line		122 miles.	
2. Voltage.		110 kV.	
3. Normal span.		1050 feet.	
	CLEARANCES.	Horizontal	Vertical.
4. Tangent towers.		19'-0" for D/C 18'-0" for S/C	10'-6"
5. Angle towers.		18'-6" " D/C 18-0" for S/C	10'-0"
6. Anchor towers.		24'-0" for D/C 22'-0" for S/C	11'-0"
7. From tower steel upto 10° swing.		4'-0"	
8. From tower steel upto 45° swing.		3'-6"	
9. From ground.		21'	
	Conductors.		
10. Material.		ACSR.	
11. Number and size.		Alluminium. 6/.186" ∠ + 7/.062" steel (0.1 Sq.in. copper equivalent ACSR conductor.)	
12. Ultimate strength.		7,385 lbs.	
13. Maximum working tension:		2,954 lbs.	
14. Factor of safety.		2.5	
15. Maximum sag in still air.		27 feet.	
	Insulators.		
16. Type.		5½" centres and 10" dia. discs.	
17. Number of units in suspension.		7	
18. Total length of suspension string.		4'6" (approximate)	
19. Mechanical strength.		12,000 lbs.	
	GROUND WIRE.		
20. Number		Crapo galvanized steel.	
21. Material		7/9 SWG.	
22. Size.		9840 lbs.	
23. Ultimate strength.		2810 lbs.	
24. Maximum working tension.		3.5	
25. Factor of safety.		27'3 "	
26. Maximum sag in still air.			

TABLE II.

Towers Details.

Item No.	Descriptions.	Type of Tower A.	B.	C.	Remarks.
1.	Overall height above ground.	86'6" 75'0"	84'0" 73'6"	87'-0" 75'0"	for D.C.towers for S.C.towers
2.	Factors of safety-				
	a) Normal conditions.	2.5	2.5	2.5	
	b) Broken wire conditions.	1.5	1.5	1.5	
3.	Safe working bearing pressure in tons per sq.foot.				Note: The bearing pressure on wet lands will be only 0.5 tons/sq. foot.
	a) Normal conditions.	1.0	1.0	1.0	
	b) Broken wire conditions.	1.67	1.67	1.67	
4.	Conductor size.	6/.186" + 7/.062"ACSR (0.1 sq.in.equivelent copper.)			
5.	Ground cable size.	7/9 SWG Crapo galvanized steel 45 tons quality.			
6.	Total No.of conductors broken on same side.	one	one	one	
7.	Maximum horizontal angle for which tower is designed with normal span but without guying.	2^{o}	30^{o}	60^{o}	
8.	Maximum working tension of power conductor.	2,954 lbs.			
9.	Maximum working tension of ground cable.	2,810 lbs.			
10.	Wind pressure on tower.	25 lbs./Sq. foot.*			* On one and a half times the exposed area of one face.
11.	Wind pressure on conductors.	15 lbs/per sq.ft.**			** On two thirds the projected area.

TABLE III.

Loadings and factors of safety.of

Item. No.	Description.	Type of tower. A.	B.	C.
	Individual Cable Supports. Case I - Simultaneous loads under normal conditions.			
1.	Power conductor supports (Cross arms)			
	a) Transverse load.	Due to 2° angle and wind on conductor.	Due to 30° angle and wind on conductor.	Due to 60° angle and wind on conductor.
	b) Downward vertical load	1000 lbs.	1100 lbs	1200 lbs.
	or			
	c) Upward vertical load.	1000 lbs.	1100 "	1200 lbs.
	d) Longitudinal load in case of terminal cross arms.	-	-	2954 lbs.
2.	Ground cable supports.			
	a) Transverse load.	Due to 2° angle and wind on con-ductor.	Due to 30° angle and wind on conductor.	Due to 60° angle and wind on conductor.
	b) Downward vertical load.	1000 lbs.	1100 lbs	1200 lbs.
	or			
	c) Upward vertical load	1000 lbs.	1100 lbs.	1200 lbs.
	d) Longitudinal load (in the dead end condition)	-	-	2810 lbs.
3.	Case II. Simultaneous loads under broken wire conditions			
	Power Conductor supports (Cross-arms.)			
	a) Transverse load.	Due to wind on conductor.		
	b) Downward vertical load	750	850	950
	or			
	c) Upward vertical load.	750	850	950
	d) Longitudinal load.	2954 lbs.	2954 lbs.	2954 lbs.
4.	Ground Cable Supports.			
	a) Transverse load.	Due to wind on cable.		
	b) Downward vertical load.	900 lbs.	1000 lbs.	1100 lbs.
	or			
	c) Upward vertical load.	900 lbs.	1000 lbs.	1100 lbs.
	d) Longitudinal load.	2810 "	2810 "	2810 "
	TOWERS. Case I - Simultaneous loads under normal conditions.			
5.	a) Wind pressure on tower.	25 lbs per square foot on 1½ times exposed area of one face.		
	b) Wind pressure on wires.	15 lbs. per sq.ft.on 2/3 projected ar		
	b) Dead load on structure.	Weight of superincumbent portion of tower and vertical loads specifie for supports.		
	d) Transverse load due to angle at the tower.	2°	30°	60°

Contd.

Table III (Contd.)

Item No.	Description.	Type of towers. A.	B	C
Case II - Simultaneous loads under broken wire conditions.				
	Stresses a,b,c,d as in (5) above but with conductors broken as shown.	Top power conductor the unbalan -ced pull should be taken as equal to .75 times working tension of the condu- ctor viz. 2954x 0.75 = 2216 lbs.	Three power conductors on the same side.	Three power conductors on the same side.

Note :- 1. The longitudienal load specified in items 1(d) and 2(d) in the case of terminal+the transverse load due to wind on conductors but not angle.

2. Each individual cable support and tower shall withstand above specified loads with factors of safety of $2\frac{1}{2}$ and $1\frac{1}{2}$ for normal and broken wire conditions,respectively.

3. The design shall be based on a span of 1050 feet for each type of tower.

ISB/27.4.

conditions as to be assured simultaneously with the upward or downward load and

APPENDIX I.

Specification No.D.210-22 of the National Electric Light Association. (U.S.A.)

Hot Galvanizing.

This specification gives in detail the test to be applied to galvanized material. All specimens shall be capable of withstanding this test.

(a) Coating:- The galvanizing shall consist of a continuous coating of pure zinc of uniform thickness and so applied that it adheres firmly to the surface of the iron or steel. The finished product shall be smooth.

(b) Cleaning:- The samples shall be cleaned before testing first with carbons, benzine, or turpentine, and cotton waste(Not with a brush), and then thoroughly rinsed in clean water and wiped dry with clean cotton waste.

The samples shall be clean and dry before each immersion in the solution.

(c) Solution:- The standard solution of copper sulphate shall consist of commercial copper sulphate crystals dissolved in cold water, about in the propertion of 36 parts by weight of crystals to 100 parts by weight of water. The solution shall be neutralised by the addition of an excess of chemically pure cupric oxide CUO). The presence of an excess of cupric oxide will be shown by the sediment of this reagent at th bottom of the containing vessel.

The neutralized solution shall be filtered before use by passing through filter paper. The filtered solution shall have a specific gravity of 1.186 at 65° F. (Reading the scale at the level of the solution) at the beginning of each test. In case the filtered solution is high in specific gravity, clean water shall be added to reduce the specific gravity to 1.186 at 65° F. In case the filtered solution is low in specific gravity filtered solution of a higher specific gravity shall b added to make the specific gravity 1.186 at 65° F.

As soon as the stronger solution is taken from the vessel containing the unfiltered neutralisexd stock solution, additional crystals and water must be added to the stock solution. An excess of cupric oxide shall always be kept in the unfiltered stock solution.

(d)--

(d) Quantity of solution:- Wire samples shall be tested in a glass jar of at least two inches inside diameter. The jar without the wire samples shall be filled with standard solution to a depth of at least four inches. Hardware samples shall be tested in a glass or earthenware jar containing at least half pint of standard solution for each hardware sample.

Solution shall not be used for more than one series of four immersions.

(e) Samples:- Not more than seven wires shall be simultaneously immersed, and not more than one sample of galvanised materials, other than wire, shall be immersed in the specified quantity of solution.

The samples shall not be grouped or twisted together, but shall be well separated so as to permit the action of the solution to be uniform upon all immersed portions of the samples.

(f) Tests:- Clean and dry samples shall be immersed in the required quantity of standard solution in accordance with the following cycle of immersions.

The temperature of the solution shall be maintained between 62° and 68° F. at all times during the following tests:-

First :- Immerse for one minute, wash and wipe dry.

Second:- Immerse for one minute, wash and wipe dry.

Third:- Immerse for one minute, wash and wipe dry.

Fourth:- Immerse for one minute, wash and wipe dry.

After each immersion the samples shall be immediately washed in clean water having a temperature between 62° and 68° F. and wiped dry with cotton waste.

In the case of No.14 galvanized iron or steel wire the time of the fourth immersion shall be reduced to half a minute.

(g) Rejection: If, after the test described in section (f), there should be a bright metallic copper deposit upon the samples, the lot represented by the samples shall be rejected.

Dull or muddy copper deposit on the zinc or within one inch of the cut end of wire shall not be considered causes for rejection.

In the case of failure of only one wire in a group of seven wires immersed.....

immersed together, or if there is a reasonable doubt as to the copper deposits, two check tests shall be made on these seven wires, and the lot reported in accordance with the majority of the set of tests.

TENDER FORM.

GOVERNMENT OF BOMBAY.

ELECTRIC GRID DEPARTMENT.

Specification No. . . T8/3-3

Jog-Hubli-Dandeli 110 kV. Transmission Line.

To

The Director General of Industries & Supplies,
Shahjahan Road, New Delhi.

Dear Sir,

Having examined the above specification, together with the accompanying drawings and the "General Conditions" therein referred to, we hereby offer to provide and carry out the works described in sections I to VI of the said specification according to the said specification, the "General Conditions" and drawings at the rates entered in the attached contract schedule of prices.

2. We hereby underteke to have materials delivered etc. ~~completed~~ within the time specified in the schedule.

3. We hereby guarantee the the particulars entered in the schedule attached to the specification.

*4. In accordance with clause 3 of the "General Conditions" we propose as sureties to the extent of 10 percent of the value of the contract

We are, Dear Sir,
Yours faithfully,

---

*This clause may be waived in the case of responsible firms.

SPECIFICATION NO. T8/S-3

Jog Karnatak 110 kV Transmission line.

Summary of totals.
(To be filled in by the tenderer.)

(For double circuit towers alternative)

Schedule.	Total price with galvanised towers.	Completion period in weeks.	Remarks.
Schedule A			
Schedule B			
Total for Schedules A. & B.			
Reduction tenderer is prepared to make if contract for all sections be awarded to him			
Net total for schedules A. & B.			

Note:- Completion periods will be reckoned from the date of receipt of order by the Contractor.

Signature.....

Date .....

Note:- This form may be filled in separately for S/C tower alternative.

SPECIFICATION NO.T8/S-3

Abstract schedule of prices, delivery, ~~periods~~

Jog Karnatak 110 kV Transmission lines.

(To be filled in by the tenderer.)

(For Double Circuit Towers Alternative)

Section No.	Description.	Total price.	Time for delivery FOR nearest Rly. Station	Remarks.
	SCHEDULE A.			
II	Towers and accessories for Galvanized towers			
III	Insulators and accessories			
IV	Power conductors and accessories.			
V	Ground cable and accessories			
VI	Guying Material.			
	Sub-Total. With Galvenized towers.			
	SCHEDULE B.			
II	Towers and accessories for Galvanized towers and accessories.			
III	Insulators and accessories			
IV	Power conductors and accessories.			
V	Ground cable & Accessories			
VI	Guying materials			
	Sub-total. With galvanized Towers.			

NOTE: Delivery & completion time will be reckoned from the date of receipt of order by the contractor.

Signature .....

Date .. ..

ISB/28.4.

Note: This form may be filled in separately for S/C Tower alternative.

SCHEDULE A- Prices, Weights and Delivery periods.

Section II - Towers and Accessories.

Jog Karnatak 110 kV Transmission lines.

(To be filled in by the tenderers.)

(For Double Circuit towers Alternative)

Item No.	Description.	Provisional quantity.	Delivery F.O.R. nearest Rly. station. For Galvanized Towers. Rate -Rs.	Total Rs.	Gross weight Tons.	Delivery period weeks.	Remarks.
1	2	3	4	5	6	7	8
1.	Standard type A Towers.						
	a) Superstructure.	550					
	b) Footing, concrete type sets of 4.	550					
2.	Standard type B towers.						
	a) Superstructure.	64					
	b) Footings, concrete type sets of 4.	64					
3.	Standard type C towers.						
	a) Superstructure.	24					
	b) Footings, concrete type sets of 4.	24					
4.	Transposition type BT tower.						
	a) Superstructure.	15					
	b) Footings.	15					
5.	Templates for stubs						
	a) Type A towers.	6 sets					
	b) Type B "	2 "					
	c) Type C "	1 "					
6.	Testing to destruction including cost of material destroy-ed.						
	a) Type A tower.	1					
	b) Type B Tower.	1					
	c) Type C Tower.	1					
	Total						
7.	Unit prices for special structures.						
	a) Superstructure steel per ton.						
	b) Footings steel per ton.						
8.	Unit rate for 10 ft. extension to tower.						
	a) Type A tower.						
	b) " B "						
	c) " C "						

SCHEDULE "A"

Section II.(Contd.)

1.	2	3	4.	5.	6.	7.	8
9.	Unit prices for						
	a) Combined danger and number plates with fittings, approximate No.	653					
	b) for phase plates approximate No.	4008					
10.	Unit prices for bird-guards complete for -						
	a) Type A towers (approximate quantity)	1650					
	b) Type B towers (approximate quantity.)	192					
	c) Type C towers. (approximate quantity.)	72					
	d) Type BT towers.	30					
11.	Unit prices for anti-climbing devices.						
	a) Type A tower (quantity)	50					
	b) " B " "	64					
	c) " C " "	24					
	d) " BT " "	15					
12.	Any other item suggested by tenderer.						

Note: Delivery and completion periods will be reckoned from the date of receipt of order by contractor.

Signature .. ..

Date . .....

SCHEDULE A - Prices, Weights, and Delivery periods.

Section II - Towers and Accessories.

Jog Karnatak 110 kV Transmission lines.

(To be filled in by the tenderer).

(For Single circuit towers Alternative).

Item No.	Description.	Provisional quantity.	Delivery FOR Nearest Rly. station. For Galvanised Towers. Rate Rs.	Total Rs.	Gross weight Tons.	Delivery period Weeks.	Remarks.
1.	Standard type A towers.						
	a) Superstructure.	565					
	b) Footing, concrete type sets of 4.	565					
2.	Standard type B towers.						
	a) Superstructure.	64					
	b) Footings, concrete type sets of 4.	64					
3.	Standard type C towers.						
	a) Superstructure	24					
	b) Footing, concrete type sets of 4.	24					
4.	Templates for stubs						
	a) Type A towers.	6 sets					
	b) Type B "	2 sets.					
	c) Type C "	1 Set.					
5.	Testing to destruction including cost of material destroyed.						
	a) Type A tower.	1					
	b) " B "	1					
	c) " C "	1					
	Total	—					
6.	Unit prices for special structures.						
	a) Superstructure steel per ton.						
	b) Footings steel per ton.						
7.	Unit rate for 10 ft. extension to tower.						
	a) Type A tower.						
	b) " B "						
	c) " C "						
8...	Unit prices for						
	a) combined danger and number plate with fittings. Approximate No.	653					
	b) phase plates -do-	3918					

9.....

SCHEDULE A

Section II.

1.	2	3	4	5	6	7	8

9. Unit prices for bird-guards complete for
   a) A tower (approx.) 1695
   b) B " " 192
   c) C " " 72

10. Unit prices for anti-climbing devices -
   a) Type A tower (Quantity approx.) 65
   b) Type B tower (Quantity approx.) 64
   c) Type C tower. (") 24

11. Any other item suggested by tenderer.

Note : Delivery and completion periods will be reckoned from the date of receipt of the order by the contractor.

signature .. ..

Date .....

SCHEDULE "A" (Contd.)

Section III - Insulators and Accessories.

Jog-Karnatak 110 kV line.
(To be filled in by the Tenderer.)

(For Double Circuit Towers Alternative)

Item No.	Description.	Provisional quantities.	Delivery F.O.R. nearest Rly. station. Rate Rs.	Delivery F.O.R. nearest Rly. station. Total Rs.	Gross weight ____ tons.	Delivery period ____ Weeks.	Remarks.
1.	2.	3	4	5	6	7	8
1.	7 unit suspension strings complete	1680					
2.	7 unit single tension strings complete.	576					
3.	7 unit double tension strings complete.	42					
4.	7 unit normal transposition strings.	15					
5.	7 unit inverted transposition strings.	15					
6.	Special arcing horns on -						
	a) No.of 7 unit suspension strings.	72					
	b) No.of 7 unit tension strings.	48					
	Total Price:						
	Unit Prices.						
8.	Suspension clamp.						
9.	Liner for suspension clamp.						
10.	Tension clamp.						
11.	Liner for tension clamp.						
12.	Liner for comealong of the automatic type.						
13.	12" links for tension strings .						
14.	21" links for tension strings.						
15.	Liner for comealong of the bolted type.						
16.	Insulator disc.						

1	2	3	4	5	6	7	8
17.	Suspension hook for suspension string.						
18.	Strain shackle for strain string.						
19.	Cotter pin for inter-connecting discs						
20.	Split pins for use with above.						
21.	Arcing horns for suspension strings.						
22.	Yoke equipment for double tension string.						
23.	Any other part of insulator string and attachment not specified above.						

Note (1) Delivery period will be reckoned from the date of receipt of order by the contractor.

(2) The insulator strings shall be supplied with 2½ % extra bolts, nuts and pins, but not clamps.

Signature .....

Date.....

ISB/28.4.

SCHEDULE "A"

Section III - Insulators and Accessories.

Jog Karnatak 110 kV line.

Alternative 2 (four single circuit tower).

(To be filled in by tenderer.)

Item No.	Description.	Provisional quantities.	Delivery F.O.R. nearest Rly. Station. Rate Rs.	Delivery F.O.R. nearest Rly. Station. Total Rs.	Gross weight Tons.	Delivery period Weeks.	Remarks.
1	2	3	4	5	6	7	8
1.	7 unit suspension strings complete.	1695					
2.	7 unit single tension strings complete.	486					
3.	7 unit double tension strings complete.	42					
4.	Special arcing horns on -						
	(a) No. of 7 unit suspension string	72					
	(b) No. of 7 unit tension strings.	48					
	TOTAL PRICE.						

Unit Prices.

5. Suspension clamp.
6. Liner for suspension clamp.
7. Tension clamp.
8. Liner for tension clamp.
9. Liner for comealong of the bolted type.
10. Liner for comealong of the automatic type.
11. Insulator disc.
12. Suspension hook for suspension string.
13. Strain shackle for strain string.
14. Cotter pin for inter-interconnecting discs.
15. Split pins for use with above.
16. Arcing horns for suspension string.
17. Yoke equipment for double tension string.

18.....

SCHEDULE "A"

Section III.

1	2	3	4	5	6	7	8

18. 12" links for tension strings.

19. 21" links for tension strings.

20. Any other part of insulator string and attachment not specified above.

Note : (1) Delivery period will be reckoned from the date of receipt of order by the contractors.

(2) The insulator strings shall be supplied with 2½% extra bolts, nuts and pins, but not clamps.

Signature .....

Date .....

ISB/19.5.

SCHEDULE "A" (CONTD.)

Section IV - Power Conductors and Accessories.

Jog Karnatak 110 kV lines.

(To be filled in by the tenderer.)

Item	Description.	Provision -al quanti -ties.	Delivery F.O.R. nearest Rly. Station. Rate Rs.	Total Rs.	Gross weight tons.	Delivery period weeks.	Remarks.
1.	2	3	4	5	6	7	8
1.	6./0.186" Al.+ 7/0.062/ steel (0.1 sq.in.dopper equivalent ACSR conductor.)	374 miles.					
2.	Joints for item No. 1	371 "					
3..	Jointing tools.	2 sets.					
4.	Jumper clamps at strain tower.	264					
5.	Automatic comealongs for item No.1.	)					
6.	Bolted type comealongs for item No.1.	)					
7.	Dynamometer for tensioning conductor.	) As recommended by tenderer.					
8.	Vibration dampers (if recommended) a) Suspension	3300					
	b) Tension	594					
9.	Any other item suggested by tenderer.						

Total Price. _____

NOTE:- Delivery time will be reckoned from the date of receipt of order by the contractor.

Signature .....

Date .....

SCHEDULE "A" (Contd.)

Section V - Ground Cable and Accessories.

Jog Karnatak 110 kV line.

(To be filled in by the tenderer.)

Item No.	Description.	Provisional quantities.	Delivery F.O.R. nearest Rly. station: Rate Rs.	Total. Rs.	Gross weight tons.	Delivery period Weeks.	Remarks.
1	2	3	4	5	6	7	8
1.	7/9 S.W.G.Grape galvanized steel ground cable.	125 miles					
2.	Joints for item No.1.	124					
3.	Jointing tools for item 1.	1 set.					
4.	Suspension clamps for ground cable.	550					
5.	Tension clamps for ground cable including bonding to towers.	206					
6.	Jumper clamps at strain towers.	88					
7.	Automatic comealongs for stringing ground wire.	As recommended by tenderer.					
8.	Bolted type comealongs for stringing ground cable.						
9.	Dynamometer for stringing ground cable.						
10.	Any other items suggested by the tenderer.						
		Total price					

Note :- Delivery time will be reckoned from the date of receipt of order by the contractor.

Signature .....

Date.....

SCHEDULE "A" (Contd.)

Section VI - Guying materials.

Jog Karnatak 110 kV lines.

(To be ~~filled~~ filled in by the tenderer.)

Item No.	Description.	Provisional quantities.	Delivery F.O.R. nearest Rly.Station. Rate Rs.	Total Rs.	Gross weight Tons.	Delivery period. Weeks.	Remarks.
1.	2	3	4	5	6	7	8
1.	5/8" Eye bolts.	28					
2.	Guy thimbles.	56					
3.	Guy clamps.	56					
4.	3/4" anchor rods.	28					
5.	7/9" S.W.G.steel guy wire.	2800 ft					
6.	Turn-buckles.	28					
7.	Anchor Rails.	28					
8.	Any other items suggested by tenderer.						

Total price- ___ _____

Note:- Delivery time will be reckoned from the date of receipt of order by the contractor.

signature .....

Date .....

ISB/28.4.

Schedule "B"

Special tools, spares and spare parts.

Jog Karnatak 110 kV lines.

(To be filled in by the tenderer.)

Note :- The tenderer is requested to fill in here such tools, spares and spare parts as he recommends for two years operation. The purchaser reserves the right to purchase such of the quantities as he finally decided upon at the prices filled in below.

Section No.	Description.	Quantity recommended.	Rate delivered FOR nearest railway station.
II	Towers and accessories.		
III	Insulators and accessories.		
IV	Conductors and accessories.		
	Ground cable and accessories.		
VI	Guying materials.		
	Total.		

Signature.....

Date. .....

I.5.5.50

SCHEDULE "C".

GUARANTEED AND OTHER PARTICULARS:

Section II - Towers.

(To be filled in by Tenderer)

Item No.	Description.	Particulars.		
1	Name of country of manufacture of steel			
2	Name and country of fabricator of towers.			
3.	Name of country of manufacture of bolts and nuts.			
4	Name of galvanizer.			
~~5~~	~~Name of supplier of paint for superstructure.~~			
5	Port of entry in India.			
6	Maximum unit working stress employed in design.	Under normal conditions.	Under broken wire conditions.	
	(a) Tension in lbs. per sq.inch of net area.			
	(b) Compression in lbs.per sq.inch of gross area.			
	(i) for ratio of slenderness l/r not less than 150.			
	(ii) for ratio of slenderness l/r less than 150.			
	(c) Shearing strell on bolts and rivets in lb. per sq.inch.			
	(d) Bearing stress on bolts and rivets in lbs. per sq.in.			
7	Maximum ratio of slenderness.			
	(a) in leg members,			
	(b) in other members having calculated stress.			
	(c) in members having nominal stresses.			
8	Net weight of tower complete with footings and crossarms in lbs.	A	B	C
9	Complete specification of steel,bolts,etc.	To be submitted separately.		
10.	Specification as regards fabrication,galvanising, painting etc. including clear statement of the extent of punching.			
12.	Specification as to size of bolt holes etc.			
13.	Packing specification.			

Signature.....

HBK/28.IV.50. Date: .....

Schedule "C" (Contd.)

Section III - Insulators.

(To be filled in by the tenderer)

Item No.	Description.	Data for seven Unit Strings.				
		Suspension.	Single Tension.	Double Tension.	Normal Transposition.	Inverted Transposition.
1.	Type (ball and socket, cap and pin).					
2.	Makers' name and country.					
3.	Port of entry in India.					
4.	Outside diameter of disc. Inches					
5.	Distances between centres of disc. "					
6.	Electro-mechanical strength of single disc. lb.					
7.	Breaking strength of single disc or unit. "					
8.	Dry flashover voltage of single disc unit. KV.					
9.	Wet flashover voltage of single disc unit. "					
10.	Puncture voltage of single disc. "					
	Weight. lb.					
12.	Breaking load of complete string. "					
13.	Dry flashover voltage of complete string with arcing horns. KV.					
14.	Dry flashover voltage of complete string without arcing horns. KV.					
15.	Wet flashover voltage of complete string with arcing horns. KV.					
16.	Wet flashover voltage of complete string without arcing horns.					

SCHEDULE "C" - Section III (Contd.).

Item No.	Description.	Data for Seven Unit Strings. Suspension.	Single Tension	Double Tension.	Normal Transposition.	Inverted Transposition.
17	Dry impulse flashover with arcing horns($1\frac{1}{2}$-40 Micro second positive wave). "KV"					
18	Dry impulse flashover without arcing horns. "KV"					
19	Corona formation voltage with normal fittings. "KV"					
20	Distance from arcing horn to crossarm. Inches.					
21	Weight of complete insulator string. lb.					
22	Breaking load of suspension or strain clamp. lb.					
23	Slipping strength of suspension or strain clamps. lb.					
24	Voltage distribution on individual units of strings with normal fittings as in service.					
	On 1st unit next to conductor KV.					
	On 2nd -do- "					
	On 3rd -do- "					
	On 4th -do- "					
	On 5th -do- "					
	On 6th -do-					
	On 7th -do-					
25	Voltage distribution on strings without arcing hours.					
	On 1st unit next to line conductor KV					
	On 2nd -do-					
	On 3rd -do-					
	On 4th -do-					
	On 5th -do-					
	" 6th -do-					
	" 7th -do-					
26	Dry flashover data of special gaps.	Maximum setting in inches flashover values. Minimum, & Flashover values.				
27	Impulse flashover data of special gaps.	Flashover value for maximum setting. Flash over value for minimum setting.				

SCHEDULE "C" - SECTION III (Contd.)

Item No.	Description.	DATA For Seven Unit Strings.				
		Suspension.	Single Tension	Double Tension.	Normal Transposition	Inverted Transposition.
28.	Packing details.	¾				
29	Creepage length of disc.					
30	Such other particulars as the tenderer may wish to give.					

NOTE:- The voltages asked for above should refer to those at sea level at 80°F. and 80 per cent relative humidity. Except the impulse values, all other voltages should be expressed in r.m.s. values at 50 cycles.

Signature:

Date:

HBK/28.IV.50.

Schedule "C" (Contd.)

Section IV- Power Conductors and Accessories.

(To be filled in by the tenderer)

Item No.	Description.
1	Maker's name and country.
2	Port of entry in India.
3	Size and number of wires, & lay of stranding, right or left hand.
4	Overall diameter.
5.	Ultimate tensile strength of cable.
6.	Weight of conductor per mile.
7.	Length in each drum.
8.	Gross weight of drum with conductor.
9.	Dimensions of drum.
10.	Resistance at 60°F. per mile.
11.	Modulus of elasticity and temperature coefficient of individual wires and of the conductor.
12.	Minimum number of twists in six-inch length of wire.
13.	Tensile strength of joints, as a percentage of the strength of conductor.
14.	Full particulars of the compression of joint assemblies and of the parallel groove clamps.
15.	Any other particulars the tenderer may wish to give.
16.	Packing details.

Signature:

Date:

Schedule "C" (Contd.)

Section V - Ground Cable.

(To be filled in by the Tenderer).

Item No.	Description.	DATA
1	Maker's name and country.	
2.	Port of entry in India.	
3	Size and number of wires in cables, and lay of stranding, right or left hand.	
4	Ultimate tensile strength of individual wire.	
5	Overall diameter of cable.	
6.	Ultimate tensile strength of cable.	
7.	Weight of cable per mile.	
8.	Length in each drum.	
9.	Combined weight of drum and cable.	
10.	Dimensions of drum.	
11.	Modulus of elasticity and temperature coefficient of individual wires and of the cable.	
12.	Minimum number of twists in six-inch length (see B.S.S.No.183/1927, clause 15(a)	
13.	Tensile strength of joints as a percentage of that of cable.	
14.	Full particulars and specification of Crapo-galvanising (to be submitted separately.)	
15.	Resistance per mile at 60°F.	
16.	Any other particulars the tenderer may wish to give.	
17.	Packing details.	

Signature:

Date:

SCHEDULE "C" - Contd.

SECTION VI - GUYING MATERIALS

(To be filled in by the tenderer)

Item No.	Description.	Data
1.	Manufacturer's name for guy materials.	
2.	Port of entry in India.	
3.	Ultimate strength of guy wire.	
4.	Ultimate strength of turnbuckle.	
5.	Ultimate strength of anchor rod.	
6.	Weight of guy wire per mile.	
7.	Weight of guy wire per drum.	
8.	Length of guy wire per drum.	
9.	Details of anchor log or plate.	
10.	Slipping strength of guy clamps.	
11.	Packing details.	
12.	Any other data the tenderer wishes to give.	

Signature:

Date:

HBK/28.IV.50.

SCHEDULE "D".

DEPARTURES FROM SPECIFICATIONS.

(To be filled in by the tenderer)

Item No.	Section:	Description.	Reference clause Numbers.

Signature

Date

HBK/28.IV.50.

GOVERNMENT OF BOMBAY

THE ELECTRIC GRID DEPARTMENT

TRANSMISSION SECTION

SPECIFICATION NO.T.8/S-4.

for

33 kV AND 11 kV TRANSMISSION LINES OF THE JOG-KARNATAK ELECTRIC GRID SCHEME

SEPTEMBER 1950

BOMBAY.

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3.	J/348	Supports for 11 kV Overhead Single Circuit Line with Telephone Line.
4.	J/359	Method of Earth Connection.
5.	J/358	Transposition arrangements for Telephone Line.
6.	J/344	Transposition arrangement for 33 kV Single Circuit Line.

ISB/12.7.50.

Instructions to Tenderers.

(i) Tenders in duplicate, each complete with all Schedules and Tender Form duly filled in, together with all accompanying tender drawings, descriptive and illustrative literature, etc., also in duplicate, must be enclosed in a sealed cover and addressed so that they are delivered not later than

1950, to

The Director General of Industries
and Supplies,
Shahajahan Road, New Delhi.

The Stores are required by Electrical Commissioner with the Government of Bombay.

(ii) In submitting the Tenders, the Schedules should be duly filled in and submitted. Complete copies of specifications are not required.

(iii) If the Tenderer has any doubt about the meaning of any portion of the "General Conditions" or this specification, he should at once submit the particulars thereof to the Electrical Commissioner with the Government of Bombay, Electric Grid Department, Foreshore Road, Bombay1 , in writing in order that the doubt may be removed before the submission of his Tender.

(iv) The Transmission lines in question have to be completed with the least possible delay and the earliest delivery date must be specified. Delivery period will be an important consideration in the award of the contract.

(v) Tenders will be opened at the office of the Director General of Industries and Supplies, New Delhi, at

in the presence of such of the Tenderers as desire to be present.

(vi) Government do not bind themselves to accept the lowest or any Tender.

SPECIFICATION NO.T8/S-4.
for
Hubli-Gadag and Harihar- Byadgi 33 kV Transmission lines and Hubli-Dharwar and Byadgi-Haveri 11 kV Transmission Lines.

SECTION I - GENERAL.

1. Scope :- This specification provides for the manufacture, testing before shipment and delivery, to the nearest Rly Station of poles, cross arms, steel work, insulators, conductors, guys, structures etc., required for the following transmission lines :--

(a) 37 miles of 33 kV single circuit line from Hubli to Gadag.

(b) 27 miles of 33 kV single circuit line from Harihar to Byadgi.

(c) 12 miles of 11 kV single Circuit line from Hubli to Dharwar.

(d) 11 miles of 11 kV single circuit line from Byadgi to Haveri.

Section II, which follows, deals with the above lines in detail.

2. Temperature, wind pressure and altitude :- The temperature outdoors may be assumed to vary from 40° to 140° F. All overhead conductors shall be strung on the assumption that the maximum temperature when exposed to the sun and when carrying current, will not exceed 140° F.

The maximum wind pressure to be assumed will be 15 lbs. per sq. ft. on 2/3ds projected area of tubular poles and conductors. For R.C.C. poles of rectangular section, full projected area of the face parallel to the line shall be assumed.

The altitude varies normally from 1500 to 2000 ft. above sea level. All materials should be suitable for satisfactory service at the maximum altitude.

3. General Description : The 33 and 11 kV lines included in this specification are to be constructed as part of the Jog Karnatak Electric Grid Scheme, which has for its purpose the supply of 3 phase 50 cycle A.C. Electrical energy, to areas situated

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situated around Sirsi, Dandeli, Hubli, Gadag and Dharwar from the Mahatma Gandhi Power House at Jog and to Ranibennur Byadgi and Haveri from the Harihar substation of Mysore Government Gadag and Dharwar substation will be supplied power from the 110/33/11 kV Hubli Receiving Station on 33 and 11 kV lines respectively while Ranibennur and Byadgi will be supplied power from step down stations on the Harihar - Byadgi 33 kV line. Haveri will be supplied power from the 33/11 kV substation at Byadgi. The neutrals of the 33 kV and 11 kV systems will be grounded solidly at the sending end substations.

Drawing No.J.241 attached to this specification shows the proposed routes of the 33 and 11 kV transmission lines.

4. General Conditions :- (a) All works covered by this specification shall be carried out in accordance with the "General Conditions of Contracts for Plant, Machinery and Manufactured Equipment "(a copy of which is forwarded herewith) except where modified by this Specification. Where the conditions of tendering or directions to the Tenderer embodied herein conflict with those specified in the "General Conditions" the former shall be binding in preference to the latter.

(b) In order that the tender can receive full consideration the whole of the information asked for in the accompanying Schedules and elsewhere in this Specification must be supplied by the Tenderer. Due consideration will be given to any special devices or attachments put forward by the Tenderer, which are calculated to enhance the general utility and safe and efficient operation of the plant.

(c) The purchaser reserves the right to reject any or all the tenders. All royalties for patents or charges for the use or infringements thereof that may be involved in the construction or use of any equipment or appliance to be furnished under this specification shall be included in the tender prices. The contractor shall portect the Purchaser against any and all claims arising on account of the use thereof, the purchaser agreeing to furnish the Contractor any appropriate information

information or assistance.

(d) The successful Tenderer will be required to grant facilities for training in the manufacture and assembly of plant included in this Specification for Indian Engineers to be nominated by the Government. The Tenderer should please state the number of engineers for whom such training will be arranged by him and the general conditions of the training

5. Departures from specification. The designs of the poles and structures may be modified at the discretion of the Tenderer, but the factors of safety and clearances specified must be adhered to.

If the Tenderer wishes to depart from the specification in any respect, he shall draw attention to such points of departure and explain fully the reasons therefor, so that the relative merits of his proposals may be considered. Unless this is done, the requirements of this specification will hold good.

6. Completeness of the contract:-- The works herein mentioned shall include all fittings, insulators, fastenings, earthing equipment, foundations etc., which may not have been specifically mentioned but which are required for the proper and efficient operation of the line. The contractor shall not be eligible for any extras in respect of all minor accessories which may not be specifically included in the contract schedules of prices, etc.

7. Drawings:- The Tenderer should submit with his tender detailed and dimensioned drawings of the pole assemblies showing full details of baseplates, finials, crossarms, insulators, conductors, guys, guy anchors, earthing and guarding arrangements, double pole structures, special structures, etc.

The contradt drawings referred to in Clause 4 of the " "General Conditions" shall be submitted within 6 weeks of placing the order.

8. Any approval which the purchaser may have given to the detailed

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detailed drawings submitted by the Contractor will not relieve the Contractor of his responsibility for the correctness of design and for the execution of the contract in all respects in accordance with the terms of the specification.

8. Tests.:- The Contractor shall furnish manufacturers' test certificates in respects of all materials. Bills will not be passed for payment until the test certificates are received and approved.

The Purchaser reserves the right of having such tests as he desires carried out at his own expense to satisfy himself that the materials conform to the requirements of the Specification.

After completion, the equipment shall be tested for one month under normal operating conditions and any materials or insulators found defective shall be replaced at the cost of the Contractor.

9. Materials and Workmanship.:- Unless otherwise specified, all materials shall be of the outdoor type of the best class and capable of satisfactory operation when exposed to tropical sun, severe atmospheric conditions and heavy rainfall. Unless otherwise specified, they shall conform to the requirements of the appropriate current British Standard Specifications. In case where British Standard Specifications are not available they shall comply with the requirements of American Standards. The workmanship shall be of the highest grade, and the entire construction in accordance with the best modern practice. No materials shall be erected unless previously passed by the Engineer.

10. Electricity Rules.:- All work shall be carried out in accordance with the latest rules under the Indian Electricity Act, and Rules unless modified by this Specification.

11. Interchangeability:- All similar materials and removeable parts of similar equipments shall be interchangeable with each other.

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12. Tools and Spare Parts : The Tenderer is requested to fill in, in Schedule B, such tools and spare parts for the materials offered under this specification as he recommends for two years' operation. The purchaser may order any quantities of these at the rates specified.

13. Prices : The prices quoted for the materials should be firm being independent of exchange variation or fluctuation in price of materials. They should be inclusive of customs, import and all other dues. If the Tenderer is unable to quote firm prices in respect of any particular item, he should endeavour to give a firm price which would hold for a period of not less than two months from the announced date of receipt of tenders. On acceptance within this period the price will be taken as absolutely firm for the contract and entered as such in the contract documents.

14. Terms of payment : Payment will be made in accordance with clause 25 of the "General Conditions" with the following modifications :-

(a) in place of "f.o.r." wherever it occurs, read "at site"

(b) in clause 25(b)(3) substitute "six months" for "twelve months".

The quantities mentioned in the accompanying schedules are only approximate. The Purchaser reserves right of revising or omitting any of the quantities at the time of placing the contract and of ordering more materials during the execution of the work at the contract rates. The contract value mentioned in clause 25 of the "General Conditions" will be based on the final quantities actually used and will be calculated at the rates given in the contract schedules of prices. No payment will be made for materials damaged or broken during transit. For any class of materials for which rates are not given in the schedule of prices, payments will be made on the basis of actual cost plus five per cent, Actual cost shall mean actual cost

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cost of materials, labour and petty supervision, but not charges for higher staff paid on a monthly or contract basis. In special structures itemised prices for the component materials should be given and payment for materials ~~xxxx~~ ~~exxxcxixxx~~ will be made on the basis of such prices.

15. Penalty : Special attention is drawn to clause 32 of the General Conditions of contract for plants, machinery and manufactured equipment.

16. Insulation : The dry and wet flashower values of the Power and telephone line insulators should be not less than the values specified below when referred to sea level at 80° F.

	Power Line insulators.			Telephone line insulators
	11KV Pin & Strain	33 kV Pin and Strain.		Pin and Shackle
Dry flash over.	74 KV	116 KV	160 KV	50 KV
Wet flash over.	53KV	95 KV	135 KV	30 KV

SECTION II - 33 kV & 11 KV Transmission lines.

17. Scope : This section relates to the manufacture, testing before shipment, delivery to the nearest Railway Station of the following 33 kV and 11 kV transmission line materials and accessories :-

(1) 37 miles of 33 kV single Circuit Line of 0.06 sq.in.copper from Hubli to Gadag.
(2) 27 miles of 33 kV single Circuit Line of 0.04 sq.in.copper from Harihar to Byadgi.
(3) 12 miles of 11 kV of 0.06 sq.in.copper single circuit line from Hubli to Dharwar.
(4) 11 miles of 11 KV 0.04 Sq.in.copper Single circuit line from Byadgi to Haveri

18. Main Features : The following are the main features of lines. :-

Item No.	Description.	Hubli to Gadag.	Harihar to Byadgi.	Hubli to Dharwar.	Byadgi to Haveri.
		33 KV S.C.	33 KV S.C.	11 KV S.C.	11 KV S.C.
1.	Nature of Supports.	32'	32'	30'	30'
		Steel Tubular or reinforced concrete or structural steel poles or rail poles or treated wood poles.			
2.	Span in feet.	400	400	300	300
3.	Power Conductor	0.06 Sq.In.	0.04 Sq.In.	0.06 Sq.In.	0.06 Sq.in.
		Stranded copper of not less than seven strands.			
4.	Telephone conductor.	No. 10 SWG Copper clad steel wire of 30 percent conductivity with breaking load of of 1600 lbs.			
5.	Wind Pressure on 2/3 Projected area of conductors and supports if tubular.	15 lbs per square foot.	15 lbs.	15 lbs.	15 lbs.

Other particulars are as given in Appendix III. The arrangement of conductors, height of supports and other details are indicated in the Drawings No. J348 & J349 The 33 kV and telephone conductors will be transposed as shown in Drawing No. J/344

19. Poles : All the poles shall be either of steel tubular type or of spun reinforced concrete or of fabricated structural steel or of treated wood or rail but designed for load and factor of safety as given, in Appendix III

For the 33 and 11 kV single circuit lines 36 ft. poles, with normal span would be used for special structures at telegraph and other crossing spans.

The crippling loads for the steel tubular poles should be based on a crippling stress of not more than 27 tons per square inch for poles of 35 to 40 ton quality. The crippling and breaking stresses on which the loads are based, as also the diameter and shell thickness of the various sections, should be clearly stated in the tender.

The fabricated steel or the spun reinforced concrete poles shall have the same crippling strength as the tubular poles specified above.

The tubular steel poles should be complete with cast iron base flanges or mild steel buckle plates and cast iron finials suitable for fixing, wherever required, 11 kV pin insulators and designed for fastening firmly to the top of the pole with not less than 3 studs of approved dimensions. Where insulators are not mounted on finials as in the case of Double Circuit lines and double pole and special structures, the holes in the finials should be suitably plugged to prevent rain water from entering the pole. A separate unit price should be given for 1:3:6 concrete casing of poles at the butt ends. This may be used where considered necessary. If treated wooden poles are offered they should be as per appendix II. Full details as to size, method of treating and period of seasoning should be clearly stated.

On angles and long spans, the poles shall be used as follows:-

(a) (i) Normal span 300' 0-15° single pole with guys and pin insulators.
15-20° double pole structures with guys and pin insulators.
20-30° double pole structures with guys and strain insulators.
Above 30° special structures. The angle shall, as far as possible, be split so that any one angle does not exceed 30°.

(ii) Span 400-500ft.on either side of pole. Double pole structures suitably guyed.

(iii) Span over 500ft.on either side of pole. Special structures.

(b) (i) Normal span 400 ft. 0.-15° Single pole with guys and pin insulators.
15-20° double pole structures with pin insulators and guys.
20-30° double pole structures with strain insulators and guys.
Above 30° special structures. The angles shall, as far as possible, be split, so that any one angle does not exceed 30°.

(ii) Span 500 to 600 ft.on either side of the pole. Double pole structures suitably guyed.

(iii) Span over 600 ft.on either side of pole. Special structures.

20. Cross-arms:- The cross-arms for the power circuit shall....

circuit shall be of tested mild steel channel iron 4"x2" for 33 kV and 3"x1½" for 11 kV, shaped as shown in the drawings

The telephone cross-arms shall be 2"x2"x¼" angle 2'-0" long. The clamps shall be of ample section and so designed that the bearing surface between them and the poles shall be as large as possible.

*The bracings shown in the drawings Nos. J.348 & J.349 are suitable only for R.C.C. or treated wood poles. For Steel tubular and Rail poles, clamps will be used for fixing the cross arm to the pole instead of the bracings. The tenderers should send detailed drawings of the crossarms and clamps or/and bracings proposed by them with the Tender.

Double channel flat cross-arms for double pole structures at large angles and double V cross-arms for uplift position and at places where the poles are stormguyed, should have suitable pipe distance pieces - between the two channels to make the cross-arms adequately staff. All cross-arms, cross-bracings and other iron work, should be supplied complete with the necessary clamps, bolts, nuts and washers. *

21. Conductors:- The high tension conductor shall be of 0.06 sq.inch size for Hubli-Gadag and Hubli Dharwar sections and of 0.04 sq.inch size for Harihar-Byadgi and Byadgi Haveri sections. The conductors shall be of bare hard drawn stranded copper of not less than 7 strands complying in all respects with B.S.I. Specification 125 of the latest issue or equivalent American Standards. Joints shall be of the McIntyre or other approved type having same conductivity as the line conductor. The length of sleeves, the number of twists required to develop the strength of the cable and details of the binding wire used, should be given in the tender.

For jumper connections at strain or shackle points, parallel groove or other suitable clamps of an approved type should be used. The cost of the binding wire, joints, clamps and other conductor accessories should be included under of the conductor. Payment for conductor will be based on the cost/ sags, jumpers and connections.

+ the route length plus 1% to cover

The purchaser reserves the right to supply the power and telephone conductors and therefore separate prices shall be given for the conductors and for the accessories under schedule (A) so that, if necessary, only the latter may be ordered.

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22. Telephone Conductors :- The telephone conductors shall be of No. 10 S.W.G.copper clad steel wire with 30 per cent conductivity and having breaking load of 1,630 lbs.

23. Insulators :

(a) 33 kV Insulators - The 33 kV high tension insulators shall be of brown glazed porcelain, complying with the A.I.E.E.standards 41 of 1930.

The pin insulators should have flashover values of 116 KV Dry and 95 KV Wet at 50-Cycles (at 80° F. and sea level), measured by sphere gap. Each pin insulator shall be fitted with a threaded thimble cemented in, to take a mild steel spindle. All pins should be galvanized and supplied complete with galvanised nuts and washers and should be suitable for a transverse working load of 800 lbs.. and should be tested for mechanical strength accordingly.

The 33 KV strain insulators shall be of the disc type, each set comprising three 10-inch discs, complete with galvanized hardware including shackles for attachment to cross arm and strain clamp and should otherwise be as stated above. These should have flashover values of not less than 160 KV Dry and 135 KV Wet . The slipping strength of the strain clamp should not be less than the ultimate strength of the conductor used.

(b) 11 kV Insulators :- All the 11 KV insulators shall be of brown glazed porcelain complying with A.I.E.E.Standards 41 of 1930 and shall have flashover values of 74 KV r.m.s.dry and 53 KV r.m.s. wet at 50 cycles (80°F and sea level) measured by sphere gap.

Manufacturer's test certificates giving complete details of the tests must be furnished and the insulators will be rejected if the results do not conform strictly to the specification.

The pin insulators shall be fitted with a threaded thimble cemented--

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cemented in to take a mild steel spindle. All pins should be galvanized and supplied complete with galvanized nuts and washers and should be suitable for a transverse working load of 800 lbs. and should be tested for mechanical strength accordingly. The strain insulators shall be of the disc type supplied complete with galvanized hardware, including shackles, strain clamps and other fittings.

24. Telephone Insulators: The telephone insulators shall be of brown glazed porcelain and suitable for a working pressure of 6,600 volts and with flashover values of not less than 50 KV Dry and 30 KV Wet at 80° F. referred to sea level. The telephone circuit shall be transposed by means of "J" pins sufficiently long to give a minimum separation of 12 inches between conductors anywhere in the span. The method of transpositon of telephone conductors is shown in drawing No. J. 358 The telephone pin insulators shall be used for all angles up to 10° and shackles for higher angles.

25. Guys - Each guy should include -

(a) a guy clamp not less than 3"x 3/8" complete with two numbers of 5/8" bolts and nuts for fastening the clamp to the pole.

(b) a 5/8" galvanized turn-buckle 10 inches long at the upper end of the guy;

(c) 7/12 SWG. galvanized steel guy wire of 40 ton quality;

(d) a 5/8" dia. galvanized stay rod 6 ft. long and approved anchoring arrangement which should be specified in the tender;

(e) The requisite number of galvanized thimbles.

26. Road Crossing:- At all important road crossings not involving double pole structures with strain insulators, double pin insulators as shown in drawings No. J should be used.

APPENDIX I.

Reinforced Concrete Supports for 33 kV and 11 KV Single Circuit Lines.

1. Scope:- :- The appendix deals with the alternative offers invited for 33 kV single circuit and 11 kV single circuit R.C.C. supports for the lines covered in Section II above.

2. Design : The details of design and construction, sizes of conductor and ground wire, span length etc., will be the same as those specified in sections I and II of the specification, except where stated otherwise.

The tenderer will submit suitable design drawings of the R.C.C. supports for straight, angle and dead end locations. The supports shall preferably be of the centrifugally spun type with suitable vertical and spiral steel reinforcements. Full particulars of the designs should be furnished in the tender.

The R.C.C. supports should comply with B.S.S. No.607 of 1935 or equivalent American standard except where mentioned otherwise.

3. Loading and factor of safety: The designs should be based on the maximum working stresses not exceeding the following :-

(a) Concrete (1:2:4)	lbs/square inch.
(i) Bending	750
(ii) Shear	75
(iii) Bond	100
(b) Steel -	lbs/square inch
(i) Bending	18,000
(ii) Shear	18,000

It is important that the work is done well with good and properly cured cement concrete not weaker than 1:2:4.

The supports shall be designed for an estimated factor of safety of 3.5 on ultimate breaking load.

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The maximum working loads shall be as per Appendix III. With the test loads equal to 2½ times the equivalent maximum working loads, there shall not be any perceptible damage to the concrete or steel.

4. Testing :- (a) Type test - One specimen R.C.C. support of each type should be manufactured by the contractor as soon as possible after the placing of the contract. It shall be erected on foundation as near as practicable to that used in the field and tested in accordance with clause 13 of B.S.I.S.No.607 of 1935. The actual factor of safety obtained shall not be less than 2.5 against Crippling Load.

(b) Routine tests - Routine tests should also be carried out in the field in accordance with clause 14 of B.S.I.S.No.607 of 1935. The permissible permanent set and uniformity shall conform to sub-clauses (c) and (d) of the said clause.

(c) The tests shall be carried out in the presence of the Departmental Engineer. Full details of the method of testing shall be furnished in the tender.

(d) The tender prices shall include the cost of carrying out all the above tests and provision of the necessary testing equipment and facilities. Poles destroyed during tests will not be paid for.

5. Cross - arms :- The Cross-arms may be of reinforced concrete, or channel-iron. If painted, channel-iron cross-arms are offered, the prices should be inclusive of a shop coat of red lead and two final coats of aluminium paint after erection. If reinforced concrete cross-arms are offered, they shall be tested for the required loading along with the supports. Full details of the design of the cross-arms, method of attachment to the R.C.C. supports etc., should be furnished in the tender.

6. Transposition :- The arrangement of transposing the 33 kV

S.b.

conductors---

conductors will be as shown in drawing No.J/344 One transposition support is required for effecting one-third of a complete transposition. The tenderer will offer a suitable design for the transposition poles.

7. Foundations :- Full particulars of the designs of foundations should be furnished in the tender. The necessary bearing surface should be provided by means of base plates (preferably R.C.C.slabs) suitabley bonded to the poles. In the case of double pole structures for angle locations, the foundations should be similar irrespective of compression or uplift.

8. Earthing :- Each type of support should be grounded efficiently by means of a coil type earthing device shown in drawing No.J/359. The earth connecting wire should be suspended preferably down the hollow centre of the pole and brought out through bushed holes just below cross-arm level and at a convenient position near the bottom of the pole. The bottom portion should be formed into earth coil while the top should be connected to the metal work of the cross-arms, and cross-arm end of the insulators.

APPENDIX II.

Specification for Treated wood poles for overhead transmission lines.

1. Introduction :- The poles shall be sound, hard grown, well seasoned, straight from butt to top and tapered uniformly from top to bottom.

2. Air Seasoning :- All poles shall be debarked immediately after felling.

All poles should be air seasoned in an airy place under cover, not exposed to sun and rain, for a period of four to six months.

Proper seasoning before treatment is vital for the durability of poles and the several factors which govern the period for sound seasoning should carefully be considered for each lot of poles. The actual period will depend

upon-- ----

upon the climate, the locati on and condition of the seasoning place, the method of piling, the season of the year and the size species and character of the timber. The correct period for any particular lot of poles is a matter for the decision of the Forest Utilisation Officer, Government of Bombay. Under no circumstances should the seasoning period be less than four dry months. The aim should be to have as long a period of seasoning as possible.

No cracked poles having large seasoning checks will be accepted.

3. Treatment: After seasoing, the poles should be treated by creosote or by a chemical solution under pressure. The treatment should be proved as having been success-ful over a large number of years in India. Full details of the treatment should be given.

4. Trimming and Roofing :- Knots above ground level shall be trimmed off flush with the body of the pole, but no shaving shall be done. Poles with loose, hollow or rotten knots will not be accepted. The pole shall be roofed approximately at an angle of 45°. The butts must be cut square and edges chamfered round.

5. Straightness :- The maximum deviation from straightness any 6 ft. length above ground line shall not exceed 2 inches. A total deviation of 3 inches is, however, permissible in the 6 ft. length from butt end. There shall not be more than one bend in any 6 feet section.

6. Sweep :- The maximum permissible sweep in one plane and in one direction is 1 inch per five feet length of pole above ground level. If the sweep is in two directions in one plane, a straight line joining the centres of the top and bottom ends of the poles above ground level must fall entirely within the body of the pole.

7. Size :- No pole shall be more than 4 inches longer or 4 inches shorter than the length specified. When the poles are not truely round, the short diameter

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diameter should not be less than 80 % of the long diameter in any one section. The sizes of the poles should reasonably conform ~~kkm~~ to the particulars given in the attached table.

8. Selection and tests :- The poles shall be subject to inspection by the Departmental Engineer at the Treatment Depot. All poles failing to satisfy the above specifications will be rejected.

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Table showing the size of poles required.

No.	Description.			
1.	Overall length.	29' to 31'	32'-34'	35' to 36'
2.	Depth underground	5'	6'	6'
3.	Minimum diameter of pole at the top.	0'-4"	0'-5"	0'-6"
4.	Maximum diameter of pole at the top.	0'-6"	0'-6"	0'-9"
5.	Minimum diameter of pole at the ground line.	0'-7"	0'-8"	0'-9½"
6.	Maximum diameter of pole at the ground line.	0'-10"	0'-10"	0'-12"

APPENDIX III - Details of Overhead lines.

Sr. No.	Description.	Hubli to Gadag.	Harihar to Byadgi.	Hubli to Dharwar.	Byadgi to Haveri.
1.	Voltage of the line kV	33	33	11	11
2.	Length of the line	Miles 37	miles 27	miles 12	miles 11
3.	Number of circuits.	1	1	1	1
4.	Normal Spam	400'	400'	300'	300'
5.	Minimum clearance to ground of Power conductor,	20'	20'	20'	20'
6.	Other clearances	(As shown in the drawings			
7.	Wind Pressure.	(15 lbs. per sq feet on 2/3 projected area of conductors and tubular poles			

8....

1	2	3	4	5	6
8.	Temperature Variation in shade.	40° F. to 100° F.			
9.	Maximum temperature of overhead conductors in sun.	140° F	140°F	140°F.	140°F
10.	Poles-				
	a) Mx Overall Length.	32'	32'	30'	30'
	b) Length Underground	5'6"	5'6"	5'	5'
	c) Transverse pull at 1' from top with length underground given above (working load)	475	459	375	350
	d) Factor of safety	3.5 Minimum against Breaking Load			
		2.5 " " clippling load.			
11.	Conductors (Power)				
	a) Material of conductor and size.	Stranded Sq.in. 0.06	Hard 0.04 sq.in.	Drawn 0.06 sq.in.	Copper conductors of not less than 7 strands.0.04 sq.in.
	b) Maximum working tension of conductor at 40° F and wind pressure stated above.	Ultimate strength/2.5			
	c) Factor of safety on ultimate strength of conductor.	Not less than 2.5			
	d) Maximum sag for normal span at 100°F and in still air, approximately.	6'6"	6'6"	3'6"	4'
	e) Strength of joints for the conductors.	Not less than 90% of the ultimate strength of the conductor.			
12.	Insulators-				
	a) Flash over values-				
	(1) Dry not less than	Pin 116' kV strain 160 kV	Pin 116kV Strain 160KV	Pin 74KV Strain 74KV	Pin 74 KV Strain 74KV
	(ii) Wet not less than	Pin 95 kV Strain 135 kV	95 kV Strain	53 kV	53kV
	b) Working Load.	Not less than 800 lbs. transverse.			
	c) Slipping strength of strain clamps.	Not less than the ultimate strength of the conductors.			
13.	Telephone Conductor-				
	a) Material of conductor and Size.	No. 10 SWG copper clad steel wire 30 % conductivity.			
	b) Maximum working tension of conductor at 40°F and wind pressure stated above.	Ultimate strength / 2.5			
	c).....				

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1	2	3	4	5	6
	c)Factor of safety on ultimate strength of conductor	Not less than 2.5			
	d)Maximum sag for normal span at 140°F in still air.	2'4"	2'4"	1'3"	1'3"
14.	Telephone Insulators-				
	a) Flash over-values-				
	(i)Dry not less than	50KV	50KV	59KV	50KV
	(ii)Wet not less than	30KV	30KV	30KV	30KV
	b) Working load	Not less than 400 lbs, transverse.			
	c) Ultimate strength of shackle / steel	Not less than the ultimate strength of No.10SWG copper clad/wire 30 per conductivity.			

Note :- The crippling load of steel tubular Poles should be based on a crippling stress of not more than 27 tons/sq. in. for poles of 35 to 40 ton quality.

ISB/19.7.50.

Tender Form.

Specification No.T8/S-4/

f o r

33 KV & 11 KV Transmission lines.

for The Jog-Karnatak Electric Grid Scheme.

To

The Director General of Industries & Supplies,—
Shahajahan Road, New Delhi..

S ir,

Having examined the above specifications for the Stores required by the Electrical Commissioner with the Government of Bombay together with the accompanying drawings and General Conditions therein referred to, we hereby offer to provide materials described in the said specification according to the said specification, General Conditions and Drawings at the rates entered in the attached Contract Schedule of Prices.

2. We hereby undertake to have the materials delivered within the times specified in the Schedules.

3. We hereby guarantee the particulars entered in the Schedules attached to specification.

*4. In accordance with Clause 3 of the General Conditions we propose as sureties to the extent of 10 per cent. of the value of the contract.

and

We are,

Sir,

Yours faithfully,

S.T. * This clause may be waived in the case of responsible firms.

ABSTRACT SCHEDULE OF PRICES AND DELIVERY PERIODS

(To be filled in by the tenderer).

Sr. No.	Description.	Approximate distance in miles.	Total price for delivery F.O.R. nearest Rly.Stn.	Delivery period weeks.
1	2	3	4	5
	Section II.			
	Part I.			
	Hubli-Gadag 33 kV S/C Transmission line.	37		
	Part II.			
	Harihar Byadgi 33 kV S/C Transmission line.	27		
	Part III			
	Hubli-Dharwar 11 kV S/C Transmission line.	12		
	Part IV			
	Byadgi Haveri 11 kV S/C Transmission line.	11		
	Total			

Note : Delivery ~~and erection~~ time will be reckoned from the date of receipt of the order by the contractor.

(Signature)... .....

Date .....

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SCHEDULE "A" - Section II.

Schedule of prices, weights and delivery period.

(To be filled in by the Tenderer).

Part I. Hubli Gadag 33 KV Single circuit Transmission line.

Item No.	Description.	Provisional quantity.	Rates Delivery F.O.R. nearest Rly.Stn.	Total price. Delivery f.o.r. nearest Rly.Stn.	Gross weight.	Time of delivery at nearest Rly. station.	Remarks.
1	2	3	4	5	6	7	8
	Poles.						
1.	32 ft. poles	500					
2.	36 ft.poles	30					
3.	40 ft. poles	8					
4.	8' V Cross arms 1'-0"	500					
5.	Flat cross arms.	500					
6.	12-0" V cross arms for Road crossing	6					
7.	8' double V cross arms for up lift and storm guyed poles.	12					
8.	9'.6" double cross arms for D.P. structures.	10					
9.	Cross bracings for D.P.Structures.	3					
10.	Transposition Cross arms.	6					
11.	Cross Bracings for Transmission structures	6					
12.	2' telephone cross arms.	520					
	Conductors						
13.	0.06 sq in.stranded copper conductor of not less than 7 strands.	113 miles					
14.	Joints	111					
15.	.....						

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1	2	3	4	5	6	7	8
15.	10 SWG copper clad steel telephone wire of 30 per cent conductivity.	75 miles.					
	Insulators.						
16.	33 kV pin Insulators complete with pin etc.	1600					
17.	33 kV strain insulators complete (3-10" discs)	350					
18.	6.6 kV Telephone Insulators.	1200					
19.	Ordinary pin for telephone pin insulators	600					
20.	"J" Pin for telephone pin insulators	600					
21.	6.6 kV Telephone shackle insulators.	150					
	Guys, Earthing etc.						
22.	Guy sets complete.	150					
23.	(a) Earthing arrangement coil type.	160					
	(b) Earthing pipe type.	40					
24.	33 kV bird guards (Clamping type)	30					
25.	Concrete for poles and structures 1:3:6 proportion per 100Cft	Unit price to be given.					
26.	Any other item suggested by the tenderer.						

Note:- (1) Delivery periods will be reckoned from the date of receipt of the order by the Contractor.
(2) Cross-arms length given above are distances between extreme bolt holes.

Date..... Signature.....

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SCHEDULE "A" - Section II.

Schedule of prices, weights, and delivery period.

(To be filled in by the Tenderer).

Part II - Harihar - Byadgi 33 kV single circuit Transmission line.

Item No.	Description.	Provisional quantity.	Rates. Delivery F.O.R. nearest Rly. Station.	Total price. Delivery f.o.r. nearest Rly.Stn.	Gross weight.	Time of delivery at nearest Rly.Stn.	Remarks.
1	2	3	4	5	6	7	8
	Poles.						
1.	32 ft.poles	360					
2.	36 ft. poles	20					
	Cross arms and Bracings.						
3.	8' V Cross arms.	360					
4.	1'0" Flat cross arm	360					
5.	~~12~~x 12'6" V cross arms for Road Crossings.	6					
6.	8'0" Double V cross arms for up lift and storm guyed poles.	12					
7.	9'6" Double Cross arms, for D.P.Structures.	10.					
8.	Cross bracings for D.P.Structures	5					
9.	Transposition Cross arms	6					
10.	Cross bracings for transposition structures.	6					
11.	2' telephone cross arms	380					
	Conductors.						
12.	0.04 sq.in.stranded copper conductor of not less than 7 strands	83 miles.					
13.	Joints for the above.	81					
14.	10 SWG copper clad						

1	2	3	4	5	6	7	8
14.	80SWG copper clad steel telephone wire of 30 percent conductivity.	55 miles.					
	Insulators.						
15.	33 kV pin insulators complete with pin etc.	1200					
16.	33 kV Strain insulators complete (2 3-10" discs).	250					
17.	6.6 kV telephone insulators.	700					
18.	Ordinary pin for telephone pin insulators.	350					
19.	"J" Pins for telephone pin insulators.	350					
20.	6.6 kV Telephone shackle Insulators	120					
	Guys, Earthing etc.						
21.	Guy sets complete	120					
22.	(a)Earthing arrangement coil type.	110					
	(b)Earthing pipe type.....	40					
23.	33 kV bird guards (Clamping type)	20					
24.	Concrete for poles and Structures 1:3:6 proportion per ~~xxx~~ 100 cft.	Unit price to be given.					
25.	Any other item suggested by the tenderer....						

Note :- 1) Delivery periods will be reckoned from the date of receipt of the order by the Contractor.
2) Cross-arms length given above are distances between extreme bolt holes.

Date (Signature)

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Schedule "A" - Section II.

SCHEDULE OF PRICES, WEIGHTS & DELIVERY PERIOD

(To be filled in by Tenderer).

PART III - Hubli Dharwar 11 kV Single circuit Transmission line.

Item No.	Description.	Provisional quantity.	Rates. Delivery f.o.r. nearest Rly.Stn.	Total price Delivery f.o.r. Nearest Rly.Stn.	Gross weight	Time of delivery f.o.r. nearest Rly. Stn.	Remarks
1.	2	3	4	5	6	7	8
	Poles						
1.	30' poles	230					
2.	36' poles	6					
3	40' poles	2					
	Cross arms and bracings.						
4.	5' V cross arms.	220					
5.	1'0" Flat cross arms.	220					
6.	5' double V cross arms for uplift and storm guyed poles.	12					
7.	V Cross arms for 7'6" road crossings.	6					
8.	7'6" double cross arms for D.P.Structures.	10					
9.	Cross bracings for D.P. structures.	5					
10.	2' telephone cross arms	220					
	Conductors.						
11	0.06" sq.in.stranded copper conductor of not less than 7 stranded.	37 miles.					
12.	Joints for the above.	~~25~~ 33					
13.	No.10 SWG copper clad steel telephone wire of 30 per cent conductivity.	25 miles.					

Insulators...

1	2	3	4	5	6	7	8
	Insulators.						
14.	11 kV pin insulators complete with pin etc.	700					
15.	11 kV ptrain insulators complete.	120					
16.	6.6 kV telephone Pin insulators	500					
17.	Ordinary Pins for telephone Pin Insulators.	250					
18.	"J" Pins for telephone Pin Insulators.	250					
19.	6.6 kV telephone shackle Insulators.	50					
	Guys, Earthing etc.						
20.	Guy sets complete.	60					
21.	(a) Earthing arrangement coil type.	80					
	(b) Earthing arrangement pipe type.	20					
22.	11 kV Bird Guards (Clamping type).	20					
23.	Concrete for poles and structures 1:3:6 mix propertion per 100 cft.	Unit price to be given.					
24.	Any other items suggested by tenderer.						

Note. 1) Delivery period will be reckoned from the date of receipt of the order by the Contractor.
2) Cross arms leggths given above are distances between extreme bolt holes.

Date. (Signature).

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SCHEDULE "A" - Section II.

Schedule of Prices, Weight and Delivery period
(To be filled in by the Tenderer).
Part IV Byadgi Haveri 11 kV single circuit
Transmission line.

Item No.	Description	Provisional quantity.	Rates Delivery f.o.r. nearest Rly.Stn.	Total price Delivery f.o.r. nearest Rly.Stn.	Gross weight.	Time of delivery f.o.r. nearest Rly. Stn.	Remark.
1	2	3	4	5	6	7	8
	Poles.						
1.	30' poles	215					
2.	36' poles	6					
3.	40' poles	2					
	Cross arms and bracings						
4.	5 ft. V cross arms	210					
5.	1 ft. flat cross arm	210					
6.	3 ft.double V cross arms for uplift and storm guyed poles	12					
7.	7'6" V cross arms for Road crossings.	6					
8.	7'-6" double cross arms for D.P.structures.	10					
9.	Cross bracings for D.P. structures	5					
10.	2 ft.telephone crossarms	210					
	Conductors.						
11.	0.04 sq. in.stranded copper conductor of not less than 7 strands.	34 miles					
12.	Joints for the above.	30					
13.	10 SWG copper clad steel telephone wire of 30 percent conductivity.	23 miles.					
	Insulators.						
14.	11 kV pin Insulators complete with pins etc:	650					
15.	11 kV Strain Insulators complete.	110					

1.	2.	3.	4.	5.	6.	7.	8
16.	6.6 kV telephone pin insulators.	400					
17.	Ordinary pins for telephone pin insulators.	250					
18.	J pins for telephone pin insulators.	230					
19.	6.6 kV telephone shackle insulators.	50					
	Guy,Earthing,etc.						
20.	Guy sets complete with	55					
21.	(a)Earthing arrangement coil type.	75					
	(b)Earthing arrangement pipe type.	20					
22.	11 kV bird guards (clamping type.)	20					
23.	Concrete for poles and structures 1:3:6 proportion per 100 cft.	Unit price to be given.					
24.	Any other item suggested by the tenderer.						

Note :- 1) Delivery and completion periods will be reckoned from the date of receipt of the order by the Contractor.
2) Cross arms length given above are distances between extreme bolt holes.

Date (Signature.)

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SCHEDULE B: Spare parts and special tools.

The Tenderer is requested to quote here for such items as he recommends for two years' operation.

The Purchaser reserves the right to order such of the materials as he may decide upon at the rates quoted herein.

(To be filled in by the Tenderer)

Item No.	Description.	No.or quantity.	Delivery at site Rate Rs.	Delivery at site Total. Rs.	Time of delivery. weeks	Remarks.
1.	Special Tools as recommended by the Tenderer.					
2.	Other items recommended by the Tenderer.					
	Total					

Note :- Delivery time will be reckoned from the date of receipt of order by the Contractor.

Signature .....

Date.....

ISB/18.7.

SCHEDULE C. Guaranteed Particulars.

(To be filled in by the tenderer).

Item No.	Description.	Data.			
		30 ft.	32 ft.	36 ft.	40 ft.
1	Poles.				
	(a) Maker's name and country				
	(b) Type of pole offered (R.C.C. wood or tubular poles or rail poles)				
	(c) Diameter and thickness of top section. Inches.				
	(d) Diameter and thickness of bottom section. Inches.				
	(e) Weight Lbs.				
	(f) Ultimate breaking load, at 1 ft. from top (~~xxxx

d) Weight per mile Lbs.

e) Diameter Inches.

f) Resistance per mile at 80° F. Ohms.

g) Minimum number of twists in 6" length of copper wire

h) Tensile strength of joints. Lbs.

i) Type of joints.

j) Size and material of tie wire.

k) Size and material of armour wire.

8 a) Safe loads on each type of cross arms.

b) Details of cross arm proposed for different types of poles-

9. Insulators. To be submitted separately with drawings.

	33 kV		11 kV		6.6 kV
	Pin	Strain.	Pin	Strain	Pin : Shackl
a) Maker's name and country					
b) Dry flashover voltage (Sphere gap) kV					
c) Wet flashover voltage (Sphere gap) "					
d) Puncture voltage "					
e) Weight of insulators Lbs.					
f) Elastic limit of pin "					
g) Ultimate strength of pin "					
h) Shipping strength of strain clamps of the strain insulators.					
i) Creepage length of insulator Inches.					
j) Ultimate strength of shackle and strain insulators. Lbs.					

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SCHEDULE D- Tests.

Before despatch from Works, the materials included in this specification, should be subjected to the following tests at the Makers' Works and test certificates furnished to the Purchaser as required in clause 8 of this specification.

(a) Poles -

1) Type Test :- B.S.S.607 of 1935 - Cl.13(a) - on one pole only.

2) Routine Test :-B.S.S.607 of 1935 - Cl.14(b) - on two ~~xxx~~ pole only.

(b) i) Insulators - 11 and 33 kV.

The following routine and type tests specified in A.I.E.E. specification No.41-1944 or A.S.A. code C 29.1 - 1944, shall be conducted and acceptance tests shall be applied as per N.E.M.A.High Voltage Insulator Standards Publication No.42-83 November 1942.

Routine tests

1) High Frequency Test (7.1.1)

2) Low Frequency Test (7.1.2)

3) Over voltage test (33 kV strain insulators only) (7.1.3)

4) Routine mechanical test(33 kV strain insulators Only) (7.2.1)

Type Tests.

5) Low frequency Dry flashover test : (4:1)

6) Low frequency Wet flashover test : (4.2)

7) Low frequency Dry-withstand voltage test (4.2.9)

8) Low frequency Wet-withstand voltage test (4.2110)

9) Impulse Flashover test (4.3).

10) Impulse - Withstand voltage test (4.4)

11) Corona Test (4.6)

12) Puncture Test (4.7)

13) Mechanical strength Test (5.1)

14) Electro-mechanical strength Test (33 kV strain insulators only) (5.2.1)

15) Porosity Test (5.4)

16) Thermal Test (5.5)

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17) Galvanising Test (6.1)

ii). Telephone insulators 6.6 kV.

The following tests as per A I.E.E. No.41-1944, or A.S.A.Code C 29.1 -1944, shall be performed and a-cceptance tests shall be applied as per N.E.M.A. No.42-83 Nov.1942

Routine Tests.

1) High Frequency Test (7.1.1)

2) Low Frequency Test (7.1.2)

Type tests.

3) Low Frequency Dry-flashover test (4.1)

4) Low Frequency Wet-flashover Test (4.2)

5) Low Frequency Dry-withstand voltage test (4.29)

6) Low Frequency Wet-withstand voltage Test (4.2.10)

7) Impulse Flashover Test (4.3)

8) Impulse - withstand voltage test (4.4)

9) Puncture Test (4.7)

10) Mechanical strength test (5.1)

11) Porosity Test (5.4)

12) Thermal Test (5.5)

13) Galvanising Test (6.1)

(c) Power conductors.

The following tests as per B.S.S.125 of 1930 :-

1) Lapping test (Cl.16-B of B.S.S.125)

2) Tensile test (Cl.16-C of B.S.S.125)

3) Resistance test (Cl.17 of B.S.S.125)

(d) Telephone conductors :-

The following tests as per Manufacturer's standard:-

1) Tensile test.

2) Resistance test.

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REPORT ON THE

JOG KARNATAK ELECTRIC GRID SCHEME

C O N T E N T S :

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ISB/3.10.50.

Report on the

JOG - KARNATAK ELECTRIC GRID SCHEME.

Chapter I.

GENERAL

Introductory :-

The Karnatak area of the Bombay State is potentially -tially rich in resources of Hydro-Electric Power and raw materials for the development of industries. But the area remains underdeveloped due to several factors one one of which is absence of cheap electric power. Preliminary investigations of the Kalinadi Basin have shown a large potential for the development of Hydro electric power. This source may take at least 8 to 10 years under the present circumstances for development. However, the development of the Jog Falls Project by the Mysore Government utilising the waters of the Sharavati River, which flows along the borders of both Mysore and Bombay States, has afforded a means of making electric power available to a restricted area of Karnatak within the course of 3 to 4 years. The present report deals with a project for the distribution of 10,000 kW available at Jog and 1,500 kW available at Harihar to a few industrial and rural load centres in the Karnatak.

Negotiations with Mysore Government.

Before any actual construction works for the Jog Falls scheme were started, the Mysore Government had discussed with the Bombay Government about the sharing of the waters of the Sharavati River and as early as in 1929-1930, it was agreed that Mysore Government could develop a scheme capable of generating 20,000 E.H.P. and of this Bombay Government should get 5,000 E.H.P. ~~and of this Bombay Government~~

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In 1943, the Mysore Government decided to develop 64,000 E.H.P. without any further consultation with the Bombay Government and this stage of development is now complete. They have further under execution the second stage, which brings the total installation at the Mahatma Gandhi Power House at Jog to 120,000 kW.

The question of utilization of Jog Power in Bombay Karnatak was not considered till the Bombay Electric Grid Department was formed. In order to obtain more than 5,000 E.H.P. promised by Mysore Government and also to get it at a rate cheaper than @.25 an./unit proposed by Mysore, considerable correspondence took place between the two Governments. Later at a Conference of the Hon. Ministers of the two Govts. held at Bangalore on 22-5-1948 the Mysore Government agreed to supply 10,000 kW in the first instance from their existing Jog Power House and promised to give priority to another 20,000 kW when the further stage was completed. Regarding the rate of supply also, they said that Bombay Government could work out three schemes assuming 0.2, 0.15 and 0.125 an./unit.

Based on these figures, a detailed scheme was worked out for the distribution of 30,000 kW in Karnatak and submitted to Government by the Electrical Commissioner on 30-8-1948. But later, when the Mysore Government were requested to confirm the above quantum of Power and the rate of supply, they reiterated their old rate of 0.25 an./unit for supply at the 110 kV busbars at Jog and limited the power to be made available at Jog to 5,000 E.H.P. They were, however, prepared to give an additional 6,000 kW at 66 kV at Harihar, for which they sent a schedule of rates which was comparatively much higher than the Jog rate.

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At this stage, the Bombay Government decided upon negotiations at ministerial level with the Mysore Government for power supply from Jog and accordingly a second conference of the Hon. Ministers of the two Governments was held at Bangalore on 10-2-1949. The Bombay delegation requested for the supply of 15,000 kW at Jog at cost of generation plus 5% and 1,500 kW at Harihar on a similar basis. The Mysore Government did not agree to meet these requirements of Bombay. It was ultimately agreed to, at the Conference that (a) They Mysore Government will give a "Minimum" of 10,000 kW at Jog and 1500 kW at Harihar and (b) the rate of supply at Jog to be 0.225 an./unit (a little less than the original rate of 0,25 an./unit) and the rate at Harihar the same as communicated by them earlier but subject to a new minimum charge and period of contract.

Approval by Government.

After this Conference, further proposals were submitted to Government on 14-4-1949 by the Electrical Commissioner based on the limited quantum of power available from the Mysore Government. This proposal was approved by Government in their letter No.2004/36-V-El dated 29-7-1949 and as directed in that letter, the detailed plans and estimates are being submitted in this report.

Area to be served.

The limited quantity of power viz.,10,000 kW at Jog and 1500 kW at Harihar cannot be distributed to the whole of Karnatak as it would be both inadequate and uneconomical. Hence the scheme is restricted to the Kanara and Dharwar districts and further the supply will be limited to 9 industrial and rural townships. The towns are Sirsi, Hanagal (500 kW for rural distribution), Dandeli, Hubli, Gadag and Dharwar

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on the Jog section and Ranibennur, Byadgi and Haveri on the Harihar section. Some 1000 kW will be distributed in the rural areas arond Hanagal and Ranibennur-Haveri Sections.

Main features.

The proposed routes of transmission lines and load centres for the scheme are shown in the enclosed drawing No. J/241. They consist of 122 miles of 110 kV double circuit line with one circuit strung at the commencement connecting Jog power House with Hubli and Dandeli, 64 miles of 33 kV single circuit lines connecting Hubli with Gadag and Byadgi with Harihar, 23 miles of 11 kV double circuit line connecting Sirsi with Hanagal, 23 miles of 11 kV single circuit lines connecting Dharwar with Hubli and Haveri with Byadgi and 22 miles of 11 kV Distribution lines. Provision has also been made in the estimates for rural distribution. The actual routes and lengths will be known when the transmission line surveys are completed. The sub-stations vary in size from 7000 kVA to 1000 kVA. The layouts of the different sub-stations are shown on Drawing No. J/391 to J/400. Towns of Hubli, Dharwar, Gadag, Sirsi, Ranibennur, Haveri, Byadgi, Hanagal and Dandeli will be supplied with electricity. Besides, textile, oil, paper alumina and match industries, railway and other workshops, small lift irrigation pumping and other rural loads will be supplied from the scheme. In order to save time during construction and erection, standard equipment and "Unit Substations" are proposed to be installed.

Present stage of the scheme.

Government have approved the surveys of transmission line routes and sub-station sites being entrusted to a contractor and accordingly the survey work has been

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entrusted to a firm of contractors and the field work was commenced in March, 1950. The survey is expected to be completed by March, 1951.

Tenders for sub-station equipment viz. Transformers, switchgear and Synchronous Condensers have been received through the Director General of Industries and supplies and have been scrutinized and on the recommendations of this Department Government have approved placing orders. Application for the allocation of the necessary foreign currency has been ~~made~~ granted and orders ~~will be~~ have been placed ~~as soon as Government of India allots it~~ through the Director General of Industries & Supplies.

The specifications for the main 110 kV and 33 and 11 kV transmission lines are sent to the Director General of Industries and Supplies and he has been requested to invite tenders.

The work of preparing specifications for Civil Engineering works is held up for want of Civil Engineering Staff. When Government approves the recommendations made in this office u.o.r. No.T.8./12/11551 dated 26-5-1950, and appoints the staff, this work will also be taken up.

Construction Programme.

Based on the early delivery of American sub-station equipment and importing of transmission line materials from foreign countries giving short delivery periods, a construction programme of works has been prepared and enclosed as statement IV. From this it will be noticed that power supply from Jog may be commenced in April 1953.

Summary of cost and load figures.

The capital cost of the scheme contemplated in this report is made up as follows :-

No.---

No.	Item.	Approx. cost in Rs. Lakhs	
1.	Surveys	1.51	1.51
2.	Transmission lines	86.89	86.89
3.	Sub-stations	64.78	64.16
4.	Civil Engineering Works.	23.11	26.11
5.	Rural Distribution.	22.79	27.41
	Sub total.	206.08	206.08
6.	Interest during construction.	6.98	6.98
	Total Capital cost:	213.06	213.06

The details of the estimates are found in the enclosed statement III.

LOAD Data.

The following are the demand maxima expected to be supplied from the various load centres.

No.	Load centre.	Maximum demand in kW At commencement.	3rd and subsequent years of service.
	Jog Hubli Section.		
1.	Sirsi	150	400
2.	Hanagal (Rural loads)	250	400
3.	Dandeli	2,400	4,100
4.	Hubli	2,650	3,600
5.	Gadag	700	850
6.	Dharwar	400	550
	Total load.	6,550	9,900
	Total diversified load	6,000	9,000
	Approximate demand at Jog (kW)	6,600	10,000
	Harihar-Haveri Section.		
7.	Ranibennur	450	650
8.	Byadgi	300	450
9.	Haveri	250	370
	Total load.	1,000	1,470
	Total diversified load	900	1,350
	Approximate demand at Harihar (kW)	1,000	1,500

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These load figures, except that of rural distribution around Hanagal, are as approved by the Government vide Government Letter No. 2004/36-V-E1(I) dated 11-5-50. Permission to include the Hanagal area also in the scheme has been requested in this office u.o.r. No. T8/3/15394 dated 7-7-1950. This has been approved vide GL. No. 2004/36-E1(1) dated 28.9.1950. The details of the load are found in statement II.

Scope for future development.

The present proposal of distribution of power has to be confined to a few selected places as it is impossible to serve more centres due to economic considerations and the limited quantum of power available. It is however observed from the load data collected and the requisitions received by the Government and by the Electric Grid Department that there are a number of villages and towns clamouring for power. Power is needed by them both for industrial and lift irrigation purposes apart from the normal lighting. There is no doubt that even a growth of about 20,000 kW for the types of loads cited above may not be an over-estimate in a period of few years. The demand will be much higher if heavy metallurgical and electro chemical industries are encouraged. It may also become necessary to develop the Kalinadi Hydro-electric stations, one by one, at an early date after the completion of the Jog scheme unless it is possible to obtain additional power from the extensions to the Jog Falls power Development scheme. The present scheme may serve as the load builder for the larger Kalinadi Hydro Electric Project.

Financial Results.

The financial statement (Statement I of the enclosure is ---

is worked out in accordance with the Indian Electricity (Supply) Act, 1948. The rates proposed to be charged for different types of loads are reasonably low. The scheme is expected to become self-supporting in the 3rd year of service, when there will be an accumulated deficit of Rs. 2.72 lakhs. This amount will be wiped out in the next three years, after which the scheme will yield a net revenue of about Rs.0.88 lakh in the sixth year and about 1.25 lakhs in the seventh and subsequent years over and above the interest at 3½ % on the capital cost of the scheme and full allowance for depreciation and operation and maintenance.

Chapter II.

Technical Features.

Layout of the system.

The power available for distribution is at two places viz. Jog and Harihar. At the Mahatma Gandhi Power House at Jog 10,000 kW will be tapped off from the 110 kV buses. The Mysore Government will provide the necessary 110 kV Oil Circuit Breaker and the required protective and metering equipment at Jog. At the Harihar sub-station of Mysore Govt. 1500 kW will be available at 66 kV. Here, the Bombay Government will have to construct one or two spans of 66 kV line including the Tungabhadra river crossing and also provide the necessary 66 kV oil circuit breaker and protective equipment. The transmission systems will operate at 3 phase, 50 cycles with solidly grounded neutral.

In the present scheme it is proposed to distribute the power available from Mysore Government as follows :- A main 110 kV double circuit line with one circuit strung for the present will be constructed from Jog to Hubli and Dandeli with a switching station at Kavalvad. This line will also be tapped at Sirsi where a 1000 kVA, 110 kV/11 kV step down station will be installed to provide for the local and Hanagal (Rural loads) area loads. At Dandeli the voltage will be stepped down to 11 kV by a 5000 kVA transformer to provide for the industrial loads anticipated at Dandeli. Hubli will be the main receiving station where the voltage will be stepped down to 33 kV by a 2000 kVA transformer to feed Gadag and to 11 kV by a 5000 kVA transformer to feed the local loads and Dharwar town. Two 2000 kVA synchronous condensers will be installed at Hubli for voltage regulation and power factor improvement. The 33 kV line will terminate at Gadag

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where the voltage will be stepped down to 11 kV by a 2000 kVA transformer to meet the local demands.

The distribution from Harihar will consist of a 2000 kVA step down station from 66 kV to 33 kV at Harihar and a 33 kV single circuit line to Byadgi. This line will be tapped at Ranibennur where the voltage will be stepped down to 11 kV by a 1000 kVA transformer to meet the local demands. At Byadgi also the voltage will be stepped down to 11 kV by a 1000 kVA transformer to meet the local and Haveri town demadds An 11 kV single circuit line will run from Byadgi to Haveri. At the above 3 substations viz. Ranibennur, Byadgi and Haveri, surplus power to the extent of about 500 kV will be left which is proposed to be distributed in the rural areas round about these places. The cost of distribution roughly estimated at Rs. ~~28.20~~ 27.41 lakhs is included in the estimates covered by this report. It is proposed to send to Government a revised proposal for the rural distribution after the load survey of the Hanagal and Ranibennur-Haveri areas are completed.

The proposed transmission line routes, electrical layout and the layout of equipment at the various sub-stations are shown in the drawings enclosed with this report.

110 kV transmission line.

The main 110 kV Transmission line from Jog to Hubli and Dandeli is about 122 miles in length and will be so routed that the present net work forms an integral part of the future Kalinadi scheme. The Jog-Sirsi line can also be retained as a tie line between the Jog and Kalinadi sheemes. It will be a single circuit line for the present but strung on double circuit towers. The line will be of 0.1 sq.in. copper equivalent A.C.S.R. conductor in vertical configuration

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with a single 7/9 S.W.G.galvanised steel earth wire mounted on the apex of the towers. The outlines of the towers proposed to be used are shown in drawing No. J. 292 enclosed. Double circuit towers are proposed to be used in order to facilitate transmission of more power at a future date if the Mysore Government agrees to supply or to transmit power from the Kalinadi Scheme on the same line or to tie Kalinadi and Jog Schemes. The Mysore Government are likely to be agreeable for this link. The towers to be used will be galvanised steel towers. The main line will pass mostly through forest area. The towers will be spaced normally at 1050 ft. spans and each will be earthed efficiently. There will be about four major river crossings. Only the crossing at the Sharavati River will require special towers.

The wind pressure prevalent in the area is 10 to 15 lbs./s.ft. The line is designed for a wind pressure of 15 lb.per sq.ft. The towers and conductors will be suitably designed to give a factor of safety of 2.5 under normal conditions and 1.5 under broken wire conditions. The design of the towers is made after due consideration of direct lightning strokes on the line. The height of the normal suspension tower will be 86'-6". The A.C.S.R. conductor, which will be equivalent to 0.1 sq.in copper, will be of stranded aluminum made up of 6 strands of 0.186" on a stranded steel core of 7 strands of 0.062". Anti-vibration dampers of approved design, will be used at all points. Suspension type insulators of standard manufacture will be used. Tangent locations will have each seven discs of 10" diameter at 5½" centres, and tension and angle towers will have strain units of seven discs each. +There will be 5 complete barrels of transposition. There will also be a telephone line on separate poles

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from Jog to Hubli and Dandeli running parallel to the Power line at a distance of about 600 ft.

The regulation of the line upto Hubli or Dandeli sub-station will be about 5.5 %.

To take care of the charging current of the line as well as to improve the power factor and to regulate the voltage at Hubli, it is proposed to instal two synchronous condensers, each of 3000 kVA (leading) capacity.

33 kV and 11 kV lines.:

The 33 kV and 11 kV transmission and distribution lines will be single circuit lines except 23 miles of double circuit 11 kV line from Sirsi to Hanagal. These lines will be carried on steel, R.C.C.,rail or treated wood poles and fitted on pin type insulators. The conductors will be strung in horizontal formation for the single circuit lines and in the vertical formation for double circuit lines. Drawing Nos. J 348 and J 349 give a general idea of the 33 kV and 11 kV line supports proposed. The design of the poles and conductors will be made on the basis of a factor of safety of 2.5 under normal working conditions and 1.5 under broken wire conditions. Stranded hard drawn copper conductors will be used for these lines. The insulators will be of standard make. The telephone wires will be strung on insulators mounted on the same poles carrying the power conductors. The insulation level proposed to be adopted for the telephone lines on the same supports is 6.6 kV, which has proved satisfactory in service elsewhere. The 33 kV lines will be transposed where necessary.

The following table gives the technical details of the 33 kV and 11 kV lines for both Jog-Hubli and Harihar-Haveri sections.

No.	Route.	Approx. length in miles.	No. of Circuits.	Voltage in kV	Section of copper in Sq.in.	Estimated load per circuit in kW.	Regulation of line @ 0.9 p.f.
	Jog-Hubli Section.						
1.	Sirsi-Hanagal	23	2	11	0.04	250	6.90
2.	Hubli-Gadag	37	1	33	0.06	900	3.06
3.	Hubli-Dharwar	12	1	11	0.06	600	6.09
	Harihar-Haveri Section.						
4.	Harihar-Ranibennur	14	1	33	0.04	1500	2.86
5.	Ranibennur-Byadgi	13	1	33	0.04	900	1.44
6.	Byadgi-Haveri.	11	1	11	0.04	400	5.30

Provision for 22 miles of 11 kV distribution lines has been made in the estimates for taking 11 kv feeders upto the consumers premises.

Lumpsum provision has been made for rural distribution in the present estimates.

Sub-stations.

The sub-stations proposed to be installed for this scheme are of the outdoor type, which are available in standard units and will be pre-fabricated so that erection time and cost will be minimum. Also the outdoor structures will be compact and the space required for the sub-stations will be reduced.

In this scheme, there are in all 11 sub-stations of which 7 sub-stations have step-down transformers and one sub-station is a H.T. switching station. Spare transformers are provided at all the transformer sub-stations.

Particulars---

Particulars of equipment.

A brief description of the equipment to be provided at each sub-station and the service for which they are meant is given below. All the sub-stations are complete with the necessary H.T. and L.T. switchgear, cables, metering and protective equipment, station service equipment and staff quarters.

(a) Jog : There is no need for the Bombay Government to provide any equipment at Jog as the necessary Oil Circuit Breaker, lightning arrestors and structures are provided by Mysore Government. The Bombay Government will, however, have to instal an anchor tower near the Mysore Government's structure and put in a jumper from the disconnecting switch that has been installed by Mysore Government.

(b) Sirsi :- This is a tapping station from the 110 kV transmission line and is situated at a distance of about 33 miles from Jog. A 1000 kVA transformer sub-station is proposed to be installed here to meet the local and Hanagal area demands. The voltage is directly stepped down to 11 kV and fed to the consumers' terminals through 2 feeders and also to Hanagal by separate feeders.

(c) Kavalvad :- This is only a switching station at a distance of about 79 miles from Jog. Here, the 110 kV line branches off, one towards Hubli and the other towards Bandeli. 110 kV Oil Circuit Breakers are provided for the outgoing lines.

(d) Dandeli :- This is about 19 miles from Kavalvad and an important sub-station of the scheme. It will serve the demands of heavy industries like Pulp and Paper Mills and Alumina refining plants. It will also become an important sub-station for the Kalinadi scheme. A 5000 kVA 110 kV/11 kV step down transfofmer will be provided at this sub-station with another as....

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(b) Sirsi :- This is a tapping station from the 110 kV transmission line and is situated at a distance of about 33 miles from Jog. A 1000 kVA transformer sub-station is proposed to be installed here to meet the local and Hanagal area demands. The voltage is directly stepped down to 11 kV and fed to the consumers' terminals through 2 feeders and also to Hanagal by separate feeders.

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as spare and from the 11 kV bus, the consumers will be fed by means of five feeders.

(e) Hubli : This is the main Receiving station for the system. It is about 24 miles from Kavalvad and is important on account of its central location as well as being the most important load centre for the scheme. From this station, supply is proposed to be made to Gadag at 33 kV and to Dharwar at 11 kV. This station has a 5000 kVA 110 kV/11 kV transformer with 9 feeders on the L.T. bus. Of these, one feeder is outgoing to Dharwar, two are for the 3000 kVA synchronous condensers and the remaining for local consumers. There is another 2000 kVA transformer stepping down from 110 kV to 33 kV which feeds the 33 kV single circuit line to Gadag. There is also a 5000 kVA 110 kV/33 & 11 kV double wound transformer to serve as common spare.

(f) Gadag : This sub-station is about 37 miles from Hubli and consists of a 2000 kVA, 33 kV/11 kV transformer with the necessary protective equipment on either side. From the 11 kV bus, 4 outgoing feeders supply the necessary power to local consumers.

(g) Dharwar :- This will be a feeder sub-station with no voltage transformation but only one incoming and 2 outgoing 11 kV Oil Circuit Breakers for two feeders.

(h) Ranagal : This will also be a feeder sub-station with 2 incoming and 2 outgoing 11 kV O.C.B. circuits.

(i) Harihar :- The Mysore Government will supply power from their 66 kV line at Harihar and as power to our sub-stations is being transmitted at 33 kV, it is necessary to have a 66 kV/33 kV sub-station on the Bombay side of the Bombay-Mysore border. This Sub-station consists of a 2000 kVA, 66 kV/33 kV transformer with the necessary O.C.B.s on either side. There will also be a spare 2000 kVA 66 kV/33 kV transformer..

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transformer.

(j) Ranibenhur:- The 33 kV Harihar Byadgi line will be tapped at a distance of 14 miles from Harihar to supply power to Ranibennur. A 1000 kVA 33 kV/11 kV transformer is provided with the other necessary equipment and 3 feeders are provided for local distribution.

(k) Byadgi :- This is the terminal sub-station for the Harihar Byadgi 33 k-V line. Here the voltage is stepped down to 11 kV by a 1000 kVA transformer and 2 feeders are provided for local consumers and a third feeder for Haveri.

(l) Haveri : This is a feeder sub-station similar to Dharwar with no voltage transformation but only with one incoming and 2 outgoing 11 kV O.C.B. circuits for feeders.

The voltages adopted for secondary transmission are lower than would appear normal to save an initial cost. Liberal use of induction regulators is contemplated to compensate for this when load develops.

Protection:-

Lightning arrestors will be provided for all the incoming lines and outgoing feeders at all the sub-stations.

The earth conductors and steel structures at all sub-stations will be efficiently earthed to a station ground bus.

The main 110 kV Jog-Hubli line will be protected by high speed earth leakage and plain overcurrent and earth-leakage relays. The 33 kV line from Harihar will also be protected similarly. The other 33 kV and 11 kV lines and feeders are protected by plain overcurrent and earth-leakage relays.

Chapter III.

Loads and Revenue.

Demand for Power : There is a considerable demand for power both in urban and rural areas of the four districts of Karnatak viz. Belgaum, Kanara, Dharwar and Bijapur. The types of load are varied in the urban areas, with industrial loads predominating while in rural areas, the main loads are those due to lift irrigation pumping and small flour, ginning and rice mills. There is also a demand for lighting loads, this being more prominent in towns and cities. As commercial crops like cotton and oilseeds grow in abundance in Bijapur and Dharwar districts, there is in particular, demand for textile and oil industries. There are sources of forest and mineral wealth which will require large quantum of power for development. But as noted earlier, these industries have not developed properly for want of cheap electric power or fuel such as coal and oil which have to be transported from long distances, and are, consequently, costly. Electricity will be in great demand for domestic, agricultural and industrial purposes in the area.

Types of load.

All the main types of load viz. industrial agricultural and domestic are covered in this scheme. Though restricted in area and quantity an attempt has been made to meet all the demands of the towns to be supplied with Jog Power. Hence while meeting the demands of the paper and aluminium industries in the initial stages, an alternative large source of supply has to be thought of to meet the full demand of these industries, in the course of the next 5 or 6 years when the 10000 kW of power available from Jog is fully utilized. While preparing this report, it ...

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it is assumed that the Kalinadi project will be executed within a few years after the completion of Jog Karnatak scheme so that the former will take over the demand of Jog Karnatak scheme immediately when it is ready and also supply the additional loads that have developed during the period.

There are possibilities of the development of ferrometallurgical, cellulose and heavy chemical industries, in the Kanara district but their consideration is beyond the scope of this report.

Detail of loads at various load centres are given in the following paragraphs.

Licensees:- Among the load centres provided for in this scheme, Hubli, Dharwar , Gadag, Haveri, Byadgi and Ranibennur are electrified towns and have licensees loads. All these places have licensees except Hubli, which is now operated by Government.

These power stations are worked by diesel sets and the cost of generation is very high. The rates and conditions of supply of Jog power to these licensees will be quite attractive to them and there will be no difficulty in changing over. But in Gadag and Haveri where there is D.C. supply at present, some difficulty may have to be experiecned during the change over from D.C. to A.C. supply.

Sirsi town will have a new licensee. There is no provision for a separate licensee at Dandeli as the Colonies of the factories contemplated may receive domestic power from their factory sub-stations. Hangal may require the Government to distribute power in the town as there is no licensee.

Agricultural industries:-

As noted earlier, the area to be served with Jog power is rich in raw cotton and oil seeds. The requirements of the existing Textile mills at Hubli and---

and Gadag have been considered in the report.

The existing small oil mill at Ranibennur is expected to expand and its requirement of 150 kW has been included.

Cotton-ginning load is not considered in this scheme for want of adequate power and also because it yields very poor revenue on account of its seasonal character and consequent poor load factor.

There is a possibility of one or two new textile mills at Hubli and Gadag being developed but they are not considered in this report on account of the shortage of power available.

Forest industries :-

Industries based on forest wealth viz. one Match Factory at Sirsi (300 kW), Pulp and Paper Mill at Dandeli (1400 kW) are provided in the estimate of loads.

There is a possibility of two or three more paper mills developing in this area but this is not considered here as no extra power is available.

Mineral industries :-

An alumina refining plant absorbing 3000 kW, proposed to be situated at Dandeli is provided for in the estimates. Aluminium reduction plant, requiring a large block of power, is not considered here as sufficient power is not availble from Mysore Government.

Rural loads:-

The requirements of the Hanagal area and those around Ranibennur, Byadgi and Haveri are mainly agriculturists requirements like small lift irrigation pumping, flour and rice mills etc. which are included in the estimates. The total power proposed to be distributed in this manner is about 1000 kW. Only lump sum provision for L.T. distribution is made in the estimates covered by this report.

B

589

Other---

Other loads:

Among the other loads are the M.S.M.Railway workshop load at Hubli, which will be 650 kW to start with and rising to 850 kW., Plywood factory at Dharwar (200 kW), Government saw mills at Dandeli (160 kW) and other small loads.

Rate Structure:-

The rates chargeable to the consumer are dependent on two factors (i) the rate payable to Mysore Government and (ii) transmission and distribution charges. As we are obtaining bulk supply from a Hydro electric power station, there will be no clause to compensate for the variation in the price of fuel.

Based on the rates payable to Mysore Government and also the load and load factor and the national importance of the industry, the rates proposed to be charged for different consumers are arrived at. These rates are comparable with the rates elsewhere and are certainly cheaper than available in any thermal plant, which any industry may think of, as an alternative to this supply. The following table shows the rates proposed for the various consumers.

No.	Type of load.	Average Rate in An./unit
	JOG-HUBLI SECTION:	
1.	Town supply	1.00 Annas/unit
2.	Match factory.	0.85 "
3.	Saw mills and Plywood factory.	0.90 "
4.	Paper Mills.	0.55 "
5.	Aluminium industry.	0.40 "
6.	Textile mills.	0.85 "
7.	Railway workshops.	0.90 "
8.	Rural load.	2.00 "
	HARWAR-HAVERI SIDE	
1.	Town supply.	1.00 An./Unit
2.	Industrial load.	0.80 "
3.	Rural load.	2.00 "
4.	Oil Mills.	0.80 "

For licensees, the energy will be delivered

the cost of

all other classes of loads, except Rural, the supply is presumed to be delivered at 11 kV busbars at the respective sub-stations and the consumers pay for the cost of service connection charges, minus the free service allowance (For Rural distribution the rates proposed are at L.T. voltages

Loads and revenue forecast:-

A statement showing the loads, units and revenue is found in statement II attached to this report, but a summary of the 1st and 3rd and subsequent years of service are noted below for ready reference.

No.	Type of load.	First year of service			3rd and subsequent years of service.		
		Demand in kW.	Units sold in millions.	Revenue in Rs. lakhs.	Demand in kW.	Units sold in millions.	Revenue per annum in Rs. lakhs.
	JOG-HUBLI SECTION						
1	Town supply.	1940	5.95	3.72	3190	9.80	6.13
2	Match factory.	100	0.438	0.23	300	1.314	0.69
3	Saw mills and plywood factory.	310	0.734	0.454	360	0.946	0.53
4	Paper Mills.	500	3.50	1.20	1400	9.80	3.37
5	Aluminium industries	2000	15.80	3.92	3000	23.60	5.90
6	Textile Mills.	1800	8.68	4.62	1900	9.13	4.84
7	Railway workshop	670	2.06	1.16	870	2.67	1.50
8	Rural load.	300	0.79	0.99	500	1.32	1.65
	Total	7600	38.02	16.29	11520	58.58	24.61
	Total diversified load. KW.	6000			9000		
	Total No. of units purchased in millions		41.82			64.44	
	Amount payable to Mysore Government Rs. lakhs.			5.90			9.05
	HARIHAR-HAVERI SECTION:						
1	Town supply.	360	1.11	0.69	600	1.84	1.14
2	Industrial load	310	1.36	0.77	400	1.75	0.98
3	Rural load.	325	0.84	1.06	500	1.32	1.64
4	Oil Mills.	200	0.88	0.49	250	1.10	0.60
5	Total.	1190	4.19	3.01	1750	6.01	4.36
	Total diversified load.kW	900			1350		
	Total No.of Units purchased in millions		4.61			6.61	
	Amount payable to Mysore Govt.Rs.lakhs			1.80*			1.79

*Minimum charge payable to Mysore Govt.

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Chapter IV.

Financial Aspect.

Capital Cost :-

The estimate of costs have bee worked out on the following basis:

(i) Surveys - Rates as per contract already awarded.
(ii) Transmission Lines - Rates as per orders placed for the South Gujarat Grid Scheme with an addition of 10% for possible price increases.
(iii) Sub-stations - Rates as per order already placed on the basis of firm prices.
(iv) Civil Engineering Works - Rates based on similar works under the North and South Gujarat Grid Schemes.
(v) Rural distribution - Lump sum provision based on assumed rate pe rate per kW distributed applicable to the area.

The total estimated capital cost of the scheme covered in this report is Rs.213 lakhs, which includes about Rs. 7 lakhs as capitalised interest charges incurred during the construction period. Abstract of estimates under the different main classifications is given in statement III. Detailed estimates are in this office files. Works will be executed mostly by contract. In preparing the estimates, the following percentages have been allowed :-

(i)	Tools and Plant.	1½ %
(ii)	Workecharged establishment	2 %
(iii)	Contingencies.	5 %
(iv)	Establishment , Head office and General charges.	8½ %

Rates of purchase :

Power will be purchased from two centres of Mysore Government and the rates payable are according to the decisions arrived at, at the Hon. Ministers' Conference held at Bangalore on 10-2-1949. The final rates arrived at are as follows :-

(a) The rates of supply at the 110 kV bus at Jog is 0.225 An./Unit.

(b) (i) The rate of supply at 66 kV. at Harihar is according to the schedule given below :-

No.-----

No.	Class and total monthly consumption in KWH.	Rate per kWH as.		Rate per month per KW of max.demand.
1	Upto 1,00,000	0.450		
2	Between 1,00,000 & 1,50,000	0.425	P	Rs. 3/- upto
3	Between 1,50,000 & 2,00,000	0.400	L	1000 kW.
4	" 2,00,000 & 3,00,000	0.375	U	Rs.2/12/- for 1000 kW.& over.
5	" 3,00,000 & 5,00,000	0.350	S	
6	" 5,00,000 &10,00,000	0.325		
7	Beyond 10,00,000	0.300		

(b)(ii) A minimum of Rs.1.525 lakhs per annum will be payable by Bombay Government and the minimum period for which the agreement for taking power and payment of the minimum charge is to be executed will be ten years.

Rate of supply:-

Notwithstanding the appreciable difference in the bulk power rates in the two areas, re-sale rates have been kept uniform treating the whole scheme as one unit. In working out the financial statement, the rate proposed under "Rate Stucture" in chapter III are adopted. It will be for consideration of Government at the appropriate time whether these rates would be reduced after 10 years of service, when the scheme is expected to yield a surplus of about Rs.1.25 lakhs per annum for the combined scheme which is only about half percent above the interest of 3½ %.

Interst:-

The interest charges are calculated at 3½% in the same way as for the other Electric Grid Schemes.

The interst charges on the capital invested during the construction period are capitalised and added to the capital cost. Interst at 3½% is also taken into account towards any balance of interst charges remaining unpaid during any year.

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Depreciation--

Depreciation:-

Depreciation charges are worked out according to the provisions set down in the Electricity (Supply) Act, 1948. Details are found in statement V and the average comes to 2.1% of the capital cost. But 2 % is adopted in the financial calculations.

Operation and Maintenance:-

The operation and maintenance charges are estimated to be 2.5 % of the capital cost and details are worked out as per statement VI.

Financial Forecast:-

The financial forecast, (statement I) is worked out by taking into consideration only revenue due to the rates of supply proposed. Electricity duty recovered will be an additional income to Government and it is not taken into account in the financial statement. Afterwards, allowances are made for the working charges in the following order as set down in the Electricity (Supply) Act, 1948. Firstly charges to Mysore Government are paid off, next the operation and Maintenance charges, thirdly depreciation and finally interest charges. Whatever charges are not paid during a particular year are carried forward and interest at 3½% paid on it. By this method, it will be seen that Rs. 3.97 lakhs will be the accumulated deficit at the end of 2 years of service and that this amount will be wiped out in another four years, after which period, the scheme will yield a surplus of about Rs.0.88 lakh in the sixth year of service and about Rs. 1.25 lakhs from the seventh and subsequent years.

ISB/22.9.50.

S. No.	Type of load	Annual load factor.	Rate per unit As.	First year of service.					
				Sirsi kW	Dan-deli kW	Hubli kW	Gadag kW	Dhar-war kW	Hana-gal kW.
1.	Town Supply	0.35	1.00	90	-	1000	500	350	-
2.	Match Factory	0.50	0.85	100	-	-	-	-	-
3.	S.Mills & P.Factory.	0.30	0.90	-	160	-	-	150	-
4.	Paper Mills	0.80	0.55	-	500	-	-	-	-
5.	Aluminium ~~Annual~~ plant.	0.90	0.40	-	2000	-	-	-	-
6.	Textile Mills	0.55	0.85	-	-	1500	300	-	-
7.	Railway Work-shop	0.35	0.90	-	-	650	20	-	-
8.	Rural Load.	0.30	2.00	-	-	-	-	-	300
9.	T o t a l.			190	2660	3150	820	500	300
10.	Total diversified load kW.			150	2400	2650	700	400	250
11.	Total load diversified between substations.								
12.	Total No.of units sold (million kWh)								
13.	Total No.of units to be purchased at Jog (with 10% loss) (million kWh)								
14.	Amount payable to Mysore Govt. per annum @ 0.225 as./unit (Rs.lakhs.)								

ISB/26.9.50.

Statement No. II
Sheet 1.

JOG KARNATAK ELECTRIC GRID SCHEME

Statement of loads, Units and Revenue (Jog Hubli Section)

Second year of service												Third and subsequent years of service.								
otal ocal kW	Units sold/ Ann. (Mill -ion kWh)	Reve -nue Rs. lakhs	Sirsi kW	Dan- deli kW	Hubli kW	Gadag kW	Dhar -war kW	Hana -gal kW.	Total local kW	Units sold/ Ann. (mill -ion kWh).	Reve -nue Rs. lakhs	Sirsi kW	Dandeli kW	Hubli kW	Gadag kW.	Dharwar kW.	Hana -gal kW	Total local kW	Units sold/ Ann. (mill -ion kWh)	Revenue Rs. lakhs.
1940	5.95	3.72	120	-	1500	550	400	-	2570	7.90	4.94	150	-	2000	600	440	-	3190	9.80	6.13
100	0.44	0.23	200	-	-	-	-	-	200	0.88	0.47	300	-	-	-	-	-	300	1.31	0.69
310	0.80	0.45	-	160	-	-	170	-	330	0.87	0.49	-	160	-	-	200	-	360	0.95	0.53
500	3.50	1.20	-	1000	-	-	-	-	1000	7.00	2.40	-	1400	-	-	-	-	1400	9.80	3.37
2000	15.80	3.92	-	2500	-	-	-	-	2500	19.80	4.95	-	3000	-	-	-	-	3000	23.60	5.90
1800	8.68	4.62	-	-	1500	350	-	-	1850	8.91	4.75	-	-	1500	400	-	-	1900	9.13	4.84
670	2.06	1.16	-	-	750	20	-	-	770	2.36	1.33	-	-	850	20	-	-	870	2.67	1.50
300	0.79	0.99	-	-	-	-	-	400	400	1.03	1.29	-	-	-	-	-	500	500	1.32	1.65
7620		16.29	320	3660	3750	920	570	400	9620		20.62	450	4560	4350	1020	640	500	11520		24.61
6550			250	3300	3100	800	500	350	8300			400	4100	3600	850	550	400	9900		
6000									7600									9000		
	38.02									48.75									58.58	
	41.82									53.63									64.44	
		5.90									7.55									9.05

Statement III(a)

JOG KARNATAK ELECTRIC GRID SCHEME

1. Abstract of Estimates:

		Rs. Lakhs.
I.	Surveys.	1.51
II.	Transmission Lines.	86.89
III.	Substations.	64.16
IV	Civil Engineering Works.	26.11
V	Rural Distribution.	27.41
	Total Rs.	206.08 lakhs.

2. Distribution of Capital Expenditure.

All amounts are in Rs. lakhs.

No.	Particulars.	1950 -51	1951 -52	1952 -53	1953 -54	1954 -55	1955 -56	Total.
I	Surveys.	0.50	1.01	-	-	-	-	1.51
II	Transmission Lines.	-	43.50	34.80	8.59	-	-	86.89
III	Sub-stations.	11.50	34.40	12.58	5.68	-	-	64.16
IV	Civil Engineering Works.	-	7.83	15.66	2.62	-	-	26.11
V	Distribution.	-	-	9.22	11.40	4.60	2.19	27.41
		12.00	86.74	72.26	28.29	4.60	2.19	206.08

ISB/14.10.

Statement No.III(b)
Sheet 1.

I ESTIMATE FOR SURVEYS:

	Rs. Lakhs.
(1) Survey of 110 kV, 33 kV and 11 kV. Transmission Lines and Sub-stations.	1.141
(2) Special tools and Plant and Scientific and Mathematical Instruments.	0.060
(3) Transmport Equipment and Maintenance.	0.124
	1.325
(4) Contingencies 5 %.	0.066.
	1.391
(5) Establishment, Head Office and General Charges. 8 ½ %.	0.118
(6) Total....	Rs. 1.509 lakhs.
	Say. Rs. 1.51 lakhs.

Note :- Out of this an estimate for Rs. 1,41,475 has been submitted to Government for administrative approval. The extra amount in the above estimate is for 23 miles of 11 kV. line survey from Sirsi to Hanagal and the Survey of distribution lines.

ISB/22.9.

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II. ESTIMATE FOR TRANSMISSION LINES.

Part A:- Transmission Lines.	Rs. Lakhs.
(1) Jog-Hubli-Dandeli Line:	
122 miles of 110 kV 0.1 sq.in. Cu.Eq., ACSR conductor single circuit line on double circuit towers @ Rs. 33,700 per mile.	44.114
(2) Hubli-Gadag line:	
37 miles of 33 kV 0.06 sq.in. copper conductor single circuit line on single circuit poles with telephone line on the same poles at Rs.16,800 per mile.	6.416
(3) Harihar (Mysore State) to 66 kV sub-station in Bombay State.	
Provision for the necessary river crossing span and 1 or 2 spans in Bombay State of 66 kV line.	0.500
(4) Harihar-Byadgi Line:	
27 miles of 33 kV 0.04 sq.in. copper conductor single circuit line on single circuit poles with telephone line on the same pole @ Rs.15,400 per mile.	4.158
(5) Hubli-Dharwar Line:	
12 miles of 11 kV 0.06 sq.in. copper conductor single circuit line on single circuit poles with telephone Line on the same pole @ Rs.15,000 per mile.	1.800
(6) Sirsi-Hanagal Line:	
23 miles of 11 kV 0.04 sq.in. copper conductor double circuit line with telephone line on the same pole at Rs. 19500 per mile.	4.485
(7) 22 miles of 11 kV. Distribution lines @ Rs. 9700 per mile	2.134
	63.607

Part B: Tele-Communication:	
(8) Jog-Hubli-Dandeli Telephone Line:	
122 miles of telephone line on separate poles @ Rs.2000 per mile.	2.440

(9)-----

(9) Telephone equipment at Sub-Stations.		
(a) Jog	0.019	
(b) Sirsi	0.094	
(c) Kavalvad.	0.094	
(d) Dandeli	0.097	
(d) Hubli	0.125	
(f) Dharwar..	0.041	
(g) Gadag.	0.060	
(h) Harihar	0.060	
(i) Ranibennur	0.081	
(j) Byadgi	0.060	
(k) Haveri	0.041	
(l) Hanagal	0.041	
(m) Line camps.	0.105	
	0.918	3.358
		66.965
(10) Allowance for Rise in prices.		6.700
		73.665
Tools and Plant 1½ %		1.105
		74.770
Work charged Establishment 2 %		1.500
		76.270
Contingencies 5 %		3.810
		80.080
Establishment, Head Office and General charges 8 ½ %		6.810
		86.890

ISB/22.9.50

III ESTIMATE FOR SUB-STATIONS.

Abstract.

No.	Sub-station.	Rs. lakhs.
1.	Sirsi	4.701
2.	Kavalvad.	3.947
3.	Dandeli	6.386
4.	Hubli	17.592
5.	Gadag	3.091
6.	Dharwar	0.904
7.	Hanagal	1.195
8.	Harihar	4.152
9.	Ranibennur	2.929
10.	Byadgi	2.905
11.	Haveri	0.904
12	3- 130 kVA, 11 kV Voltage regulators.	0.750
		49.456
	Erection.	4.950
		54.406
	Tools and Plants 1½ %	0.814
		55.220
	Workcharged Establishment 2 %	1.100
		56.320
	Contingencies. 5 %	2.820
		59.140
	Establishment Head Office & General charges 8 ½ %.	5.020
	Total Rs.	64.160

ISB/24.10.50

III. Estimate for Sub-Stations.

Details.

(1) **Sirsi Substation:**

(a) Outdoor Sub-Station consisting of -

(i) Steel structures, mountings insulators, busbars etc.

(ii) 1-110 kV outgoing Discon. Switches with grounding blades.

(iii) 1- 110 kV Discon. switch & fuses for the transformer.

(iv) 2-1000kVA 110/11 kV transformers provided with flat rollers one connected & 1 spare, and provided with one set of spares.

(v) 1-11 kV outdoor transformer O.C.B. with disconnecting switches, meters, instruments and relays.

(vi) 4-11 kV outdoor feeder O.C.Bs. with disconnecting switches, meters, instruments and relays.

(vii) 1 set - 11 kV. Potential Transformers with fuese disconnecting switches.

(viii) 1-25 kVA. 11 kV/0.4 or 0.22 kV. station sergice transformer with 11 kV. fuse disconnects and necessary outdoor Low Voltage equipment for 3 feeders.

(iv) 1 set 110 kV. station type lightening Arresters with live line disconnecting clamps and 1 operating pole.

(x) 4 sets 11 kV pellet type lightning arresters. 4.234

(b) Other connected works:
(i) Foundations & Trenches.
(ii) Sub-station lighting.
(iii) Sub-station Fencing.
(iv) Pulley block and Gantry. 0.467

Total 4.701

b00

(2) KAVALVAD SUB-STATION.

(a) Outdoor sub-station consisting of -

(i) Steel structures, mountings, insulators, busbars etc.

(ii) 3-110 kV disconnecting switches with grounding blades, one incoming 2 outgoing.

(iii) 2-110 kV Disconnecting switches for the two O.C.B.s.

(iv) 1-110 kV single pole fuse disconnecting switche for the P.T.

(v) 2-110 kV 1500 MVA outdoor oil Circuit breakers with instruments and relays.

(vi) 1-48 V Battery and trickle charger mounted in weather proof cabinet.

(vii) 1-500 VA Single phase 1,15,000/115 volts Potential transformer .

(viii) 3 sets - 110 kV station type lightning arresters with live line disconnecting clamps and 1 operating pole.

Rs. 3.651

(b) Other connected works:

(i) Foundations and Trenches.

(ii) Sub-station lighting.

(iii) Sub-station fencing.

0.296

Total Rs. 3.947 lakhs

ISB/25.9.

(3) DANDELI SUB-STATION.

(a) Outdoor sub-station consisting of — Rs. lakhs.

(i) Steel structures, mountings, insulators, bus bars etc.

(ii) 1-110 kV disconnecting switch.

(iii) 1-110 kV fuse disconnecting. switches for the transformer.

(v) 2-5000 kVA 110/11 kV transformers provided with flat rollers, one connected, one spare, and provided with one set of spares.

(v) 1-11 kV outdoor transformer O.C.B. with disconnecting switches, meters, instruments and relays.

(vi) 5-11 kV outdoor feeder O.C.B.s with disconnecting switches, meters, instruments and relays.

(vii) 1 set - 11 kV potential transformers with fuse disconnecting switches.

(viii) 1-50 kVA 11 kV/400 V station service transformer with 11 kV fuse disconnect -ing switches and necessary outdoor L.T. equipment for three feeders.

(ix) 1 set 110 kV station type lightning arrestors with live line disconnecting clamps and operating pole.

(x) 5 sets - 11 kV pellet type lightning arrestors. ~~5.836~~ 5.372

(b) Other connected works:

(i) Foundations and trenches.

(ii) (ii) Sub-station lighting.

(iii) Sub-station fencing.

(iv) Travelling crane and Gantry.

(v) Transformer truck.

(vi) Transformer track. 1.014

Total ~~6.708~~ 6.386

ISB/25.9.

602

(4) HUBLI RECEIVING STATION;

(a) Outdoor substation consisting of :

(i) Steel structures, mountings, insulators, busbars, etc.

(ii) 8-110 kV. disconnecting switches without grounding blade.

(iii) 1-110 kV disconnecting switch with grounding blade.

(iv) 2 sets 110 kV fuse disconnecting switches for 2 transformers.

(v) 1-2000 kVA 110/kV 33 kV transformer provided with flat rollers (connected).

(vi) 1-5000 kVA 110/11 kV transformer provided with flat rollers (connected).

(vii) 1-5000 kVA, 110/330&11 kV transformer provided with flat rollers (spare). and provided with one set of spares.

(viii) 1-33 kV, 500 MVA outdoor oil circuit breaker with disconnecting switches, meters, instruments and relays.

(ix) 1-11 kV outdoor transformer O.C.B. with disconnecting switches, meters, instruments and relays.

(x) 5-11 kV outdoor feeder O.C.Bs. with disconnecting switches, meters, instruments and relays.

(xi) 4-11 kV outdoor o.c.bs. for 2 synchronous condensers, with disconnecting switches, meters, instruments and relays.

(xii) 2-11 kV, 3000 kVA (leading) synchronous condensers with necessary control equipments, meters, instruments relays and necessary Power cable for connection.

(xiii) 1-33 kV outdoor potential transformer with fuse disconnecting switches.

(xiv) 1-11 kV outdoor potential transformer with fuse disconnecting switches.

(xv) 1-100 kVA 11 KV/400 V station service. transformer with 11 kV fuse disconnecting switches and necessary outdoor L.T. equipment for 3 feeders.

(xvi) 1 set 110 kV station type lightning arrestors.

(xvii) 1 set 33 kV station type lightning arrestors.

(xviii) 5 sets 11 kV pellet type lightning arrestors. Rs. ~~15,000~~ 15.090

604

(b).....

(b) Other connected works.

(i) foundations and trenches.
(ii) Sub-station outdoor lighting.
(iii) Sub-station fencing.
(iv) Travelling crane and gantry.
(v) Oil filler and testing equipment.
(vi) Oil storage and piping.
(vii) Laboratory equipment.
(viii) Workshop equipment.
(ix) Transformer truck.
(x) Transformer truck.

2.502
=======
Total ~~18.608~~ lakhs
========
17·592

ISB/25.9.

95) GADAG SUB-STATION :

(a) Outdoor sub-station consisting of :

(i) Steel structures, mountings insulators, busbars.etc.

(ii) 1- 33 kV disconnecting switch

(iii) 1 -33 kV fuse disconnecting switch for transformer.

(iv) 2 - 2000 kVA 33/11 kV transformers provided with flat rollers ~~one~~ one connected, one spare, and provided with one set of spares.

(v) 1 - 11 kV outdoor transformer O.C.B. with disconnecting switches, instruments, meters & relays.

(vi) 4 - 11 kV outdoor feeder O.C. Bs. with disconnecting switches, meters, instruments and relays.

(vii) 1 - 25 kVA 11 kV/400 V station service transformer with 11 kV fuse disconnecting switches and necessary outdoor L.T. equipment for 3 feeders.

(viii) 1 set - 33 kV station type lightning arrestors.

(ix) 4 sets - 11 kV pellet type lightning arrestors.

(x) 1-11 kV outdoor potential transformer with fuse disconnecting switches. ~~2.761~~ 2.624

(b) Other connected works.

(i) Foundations and trenches.

(ii) Sub-station outdoor lighting.

(iii) Substation fencing.

(iv) Pulley block and gantry. 0.467

Total. Rs. ~~3.228~~ lakhs 3.091

ISB/25.9.

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(6) Dharwar Sub-Station:

(a) Outdoor sub-station consisting of : Rs. Lakhs.

(i) Steel structures, mountings, insulators, bus bars etc.

(ii) 1 - outdoor 11 kV O.C.B. for incoming line with disconnect -ing switches, meters, instruments and relays.

(iii) 2 - 11 kV outdoor feeder O.C.B.s with disconnecting switches, meters, instruments and relays.

(iv) 1 - 11 kV potential transformer with fuse disconnecting switches.

(v) 1 - 25 kVA, 11 kV/400 V station service transformer with 11 kV fuse disconnecting switches & necessary outdoor L.T.equipment for 3 feeders.

(vi) 3 sets - 11 kV pellet type lightning arrestors. ~~0.851~~ 0.903

(b) Other connected works:-

(i) Foundations and trenches.

(ii) Sub-station outdoor lighting.

(iii) Sub-station fencing. 0.101

Total ~~0.904~~ (0.904)

(7) MANAGAL SUB-STATION. Rs. Lakhs.

(a) Outdoor sub-station consisting of :

(i) Steel structures, mountings, insulators, busbars etc.

(ii) 4 - Outdoor 11 kV O.C.Bs. 2 for incoming & 2 for outgoing with disconnecting switches, meters, instruments and relays

(iii) 1 - 11 kV potential transformer with fuse disconnecting switches.

(iv) 4 sets . 11 kV pellet type lightning arrestors. ~~1.159~~ 1.094

(b) Other connected works:-

(i) Foundations and trenches.

(ii) Sub-station outdoor lightning.

(iii) Sub-station fencing. 0.101

Total ~~1.260~~ 1.195

(a)(iv)** 1-25 kVA 11 kV/400 V station service transformer with 11kV fuse disconnecting ~~fuses~~ switches and necessary outdoor L.T.equipment for 3 feeders.

ISB/25.9.

606

(8) HARIHAR SUB-STATION:

(a) Outdoor sub-station consisting of :

Rs. lakhs.

(i) Steel structures, mountings, insulators, busbars etc.

(ii) 1 - 66 kV outdoor O.C.B. for transformer, with disconnecting switches, meters, instruments and relays.

(iii) 1 - 33 kV outdoor O.C.B. with disconnecting switches, meters, instruments and relays.

(iv) 2 - 2000 kVA, 66 /33 kV transformers provided with flat rollers one connected and one spare, and provided with one set of spares.

(v) 1 - 33 kV. Potential transformer with fuse disconnecting switches.

(vi) 1 - 48 V battery with trickle charger.

(vii) 1 - 100 kVA 33 kV/400 V station service transformer with 33 kV fuse disconnecting switches and necessary outdoor L.T. equipment for 3 feeders.

(viii) 1 set - 66 kV station type lightning arrestors.

(ix) 1 set - 33 kV station type lightning arrestors.

~~3,883~~
3·379

(b) Other connected works.

(i) Foundations and trenches.

(ii) Sub-station outdoor lighting.

(iii) Substation fencing

(iv) Pulley Block and gantry.

0.773

4·152

Total ~~4,356~~

ISB/25.9.50.

(9) RANIBENNUR SUB-STATION:

(a) Outdoor sub-station consisting of : Rs. lakhs.

(i) Steel structures, mountings, insulators, busbars etc.

(ii) 1 - 33 kV disconnecting switches with grounding blades, for the outgoing line.

(iii) 1 - 33 kV outdoor oil circuit breaker with disconnecting switches, meters, instruments and relays.

(iv) 2 - 1000 kVA 33/11 kV transformers, provided with flat rollers one connected and one spare and provided with one set of spares.

(v) 1 - 11 kV outdoor transformer O.C.B. with disconnecting switches meters, instruments and relays.

(vi) 3 - 11 kV outdoor feeder O.C.Bs with disconnecting switches, meters, instruments and relays.

(vii) 1 - 48 V battery with trickle charger.

(viii) 1-11 kV outdoor potential transformer with fuse disconnecting switches.

(ix) 1 - 25 kVA, 11 kV/400 V station service transformer with 11 kV fuse disconnecting switches and necessary outdoor L.T. equipment for 3 feeders.

(x) 1 set - 33 kV station type lightning arrestors.

(xi) 3 sets - 11 kV pellet type lightning arrestors.

2·462

(b) Other connected works.:-

(i) Foundations and trenches.

(ii) Sub-station outdoor lighting.

(iii) Sub-station fencing.

(iv) Pulley Block and gantry.

0.467 *

Total: 2·929

ISB/25.9.50.

608

(10) BYADGI SUB-STATION:

(a) Outdoor sub-station consisting of : Rs.lakhs.

(i) Steel structures, mountings, insulators, busbars, etc.

(ii) 1 - 33 kV outdoor O.C.B. with disconnecting switches, meters, instruments and relays.

(iii) 2 - 1000 kVA 33/11 kV transformers provided with flat rollers, one connected and one spare, and provided with one set of spares.

(iv) 1 - 11 kV outdoor transformer O.C.B. with disconnecting switches, meters, instruments and relays.

(v) 3 - 11 kV outdoor feeder O.C.Bs with disconnecting switches, meters, instruments and relays.

(vi) 1 - 48 V battery with trickle charger.

(vii) 1 - 11 kV outdoor potential transformer with fuse disconnecting switches.

(viii) 1 -25 kVA, 11 kV/400 V station service transformer with 11 kV fuse disconnecting switches and necessary outdoor L.T. equipment for 3 feeders.

(ix) 1 set - 33 kV station type lightning arrestors.

(x) 3 sets - 11 kV pellet type lightning arrestors. ~~2.584~~ 2.438

(b) Other connected works:

(i) Foundations and trenches.

(ii) Sub-station outdoor lighting.

(iii) Sub-station fencing.

(iv) Pulley Block and gantry. 0.467

Total. ~~3.051~~ 2.905

ISB/25.9.50.

(11) HAVERI SUB-STATION:

	Rs.lakhs.
(a) Outdoor sub-station consisting of -	
(i) Steel structures, mountings, insulators, busbars etc.	
(ii) 1 - 11 kV outdoor O.C.B. for incoming line with disconnecting switches, meters, instruments and relays.	
(iii) 2 - 11 kV outdoor O.C.Bs. for feeders with disconnecting switches, instruments, meters and relays .	
(iv) 1 - 11 kV potential transformer with fuse disconnecting switches.	
(v) 1 - 25 kVA, 11 kV/400 V station service transformer with 11 kV fuse disconnecting switches and necessary outdoor L.T. equipment for 3 feeders.	
(vi) 3 sets - 11 kV pellet type lightning arrestors.	
	~~0.851~~ 0.803
(b) Other connected works.	
(i) Foundations and trenches.	
(ii) Sub-station outdoor lighting.	
(iii) Sub-station fencing.	0.101
Total	~~0.952~~ 0.904

ISB/25.9.50.

STATEMENT NO.III (b)
(Sheet 4.)

IV Estimate for Civil Engineering Works:

A B S T R A C T

		Rs. Lakhs.
(1)	Sirsi	2.208
(2)	Kavalvad.	1.870
(3)	Dandeli.	1.985
(4)	Hubli	5.537
(5)	Gadag.	1.568
(6)	Dharwar.	0.704
(7)	Hanagal	1.294
(8)	Harihar.	1.410
(9)	Ranibennur	2.612
(10)	Byadgi	1.458
(11)	Haveri	0.781
(12)	Line Camps.	0.958
		22.468
	Work charged Establishment 2%	0.450
		22.918
	Contingencies 5%	1.146
		24.064
	Establishment, Head office and General Charges 8½%	2.046
		26.110

ISB/25.9.50

IV. Estimate for Civil Engineering Works:

	Rs. Lakhs.
(1) Sirsi:	
(i) Land.	0.064
(ii) Sub-station buildings.	0.343
(iii) Residential Buildings.	1.341
(iv) Lighting, water supply, drainage, Roads, Fencing.	0.460
	2.208
(2) Kavalvad:	
(i) Land.	0.064
(ii) Sub-station Buildings.	0.295
(iii) Residential Buildings.	1.121
(iv) Lighting, water supply etc.	0.390
	1.870
(3) Dandeli:	
(i) Land.	0.064
(ii) Sub-station Buildings.	0.570
(iii) Residential Buildings.	0.991
(iv) Lighting, water supply etc.	0.360
	1.985
(4) Hubli:	
(i) Land.	0.128
(ii) Sub-Station Buildings.	1.340
(iii) Residential Buildings.	2.939
(iv) Lighting, water supply etc.	1.130
	5.537
(5) Gadag:	
(i) Land.	0.048
(ii) Sub-Station Buildings.	0.209
(iii) Residential Buildings.	0.991
(iv) Lighting, water supply etc.	0.320
	1.568
(6) Dharwar:	
(i) Land. ----	

612

(6) Dha-rwar:

(i) Land.	0.032
(ii) Sub-station Buildings.	0.071
(iii) Residential Buildings.	0.511
(iv) Lighting,water supply etc.	0.170
	0.784

(7) Hanagal:

(i) Land.	0.032
(ii) Sub-station buildings.	0.071
(iii) Residential Buildings.	0.916
(iv) Lighting,water supply etc.	0.275
	1.294

(8) Harihar.

(i) Land.	0.048
(ii) Sub-station buildings.	0.161
(iii) Residential Buildings.	0.926
(iv) Lighting,water supply etc.	0.275
	1.410

(9) Ranibennur.

(i) Land.	0.064
(ii) Sub-st tion Buildings.	0.293
(iii) Residential Buildings.	1.695
(iv) Lighting, water supply etc.	0.560
	2.612

(10) Byadgi:

(i) Land.	0.048
(ii) Sub-station Buildings.	0.209
(iii) Residential Buildings.	0.926
(iv) Lighting, water supply etc.	0.275
	1.458

(11) Haveri.

(i) Land.	0.032
(ii) Sub-station Buildings.	0.071
(iii) Residential Buildings.	0.511
(iv) Lighting,water supply , etc.	0.170
	0.784

(12) Line Camp at Siddapur,Siddalgundi and Annigiri.

(i) Land.	0.020
(ii) Residential Buildings.	0.878
(iii) Wells and Fencing.	0.060
	0.958

613

ISB/25.9.50

STATEMENT III (b)
(sheet 5)

V Estimate for Rural Distribution :

(In Rural Area).

500 kW, to be distributed in Ranibennur, Haveri areas.

500 kW, to be distributed in Hanagal area.

	Rs. lakhs.
Cost of distribution @	
Rs. 2400 per kW	24.00
Contingencies 5 %.	1.20
	25.20
Establishment, Head office and	
General charges 8	2.21
	27.41

Say Rs. 27.41 lakhs.

ISB/14.10.50.

STATEMENT NO.V.

JOG - KARNATAK ELECTRIC GRID SCHEME:

Calculation of Depreciation.

(According to the provision of the Electricity (Supply) Act 1948).

No.	Item.	Capital cost. Rs. lakhs	90% of the capital cost. Rs.lakhs	Estimated life in years.	Sinking Fund at 3% interest. %	Amount of sinking fund on 90% of the capital cost. Rs. lakhs.
1.	Surveys.	1.38	1.24	50	0.89	0.01
2.	Transport equipment.	2.13	0.12	7	13.05	0.02
3.	Land.	0.75	-	--	-	-
4.	Buildings.	25.36	22.82	50	0.89	0.20
5.	Transmission lines 110 and 33 kV.	71.61	64.45	30	2.10	1.35
6.	Transmission lines 11 kV	10.91	9.82	25	2.74	0.27
7.	Telephone lines.	3.17	2.85	25.	2.74	0.08
8.	Telephone equipment.	1.20	1.09	20	3.72	0.04
9.	Distribution.	22.79	20.51	25	2.74	0.56
10.	Transformers	19.23	17.31	35	1.65	0.29
11.	Switchgear.	43.53	39.18	20	3.72	1.46
12.	Synchronous condensers.	6.02	5.42	35	1.65	0.09
		206.08				4.37

$$\text{Average depreciation} = \frac{4.37}{206.08} \times 100 = 2.12\ \%$$

2 +% is adopted in the financial calculations.

ISB/25.9.50.

Statement No. VIII.
Sheet 1.

JOG KARNATAK ELECTRIC GRID SCHEME.

Calculation of Operation and Maintenance charges:

		Rs. lakhs
1.	Salaries. (as per details enclosed.)	3.35
2.	Waste, Oil, spares and Minor repairs.	1.25
		4.60

Total capital cost = Rs.195.87 lakhs.

$$\text{Average Operation and Maintenance charges} = \frac{4.60}{195.87} \times 100 = 2.35\ \%$$

2.5 % is adopted in the financial calculations.

ISB/25.9.50.

Statement No. VI.

Sheet 2.

STATEMENT SHOWING STAFF SALARIES PER ANNUM.

	Rs. per annum.
Sirsi	27,780
Kavalvad.	22,060
Dandeli	21,180
Hubli	1,11,780
Gadag.	21,180
Dharwar.	8,280
Hanagal	18,540
Harihar.	18,780
Ranibennur.	42,900
Byadgi	19,740
Haveri	8,280
Line Camps.	14,880
	3,34,380

Say Rs. 3.35 lakhs.

ISB/25.9.50.

Government of Bombay
Finance Department

Report of the Public Accounts Committee on the Appropriation Accounts, 1946-47, and the Audit Report, 1948

Volume I—Report

[*For official use only*]

BOMBAY
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1949

[redacted]ittee on the Appropriation Accounts of the
[redacted]r the Year 1946-47 and the Audit
[redacted] thereon.

Report of the Public Accounts Committee on the Appropriation Accounts of the Government of Bombay for the Year 1946-47 and the Audit Report thereon.

The Committee consists of the following members :—

(1) The Honourable Mr. V. L. Mehta, Minister for Finance, (*Chairman*).
(2) Mr. N. S. Kajrolkar,
(3) Mr. G. W. Joshi,
(4) Mr. M. N. Memane,
(5) Mr. R. S. Hukerikar,
(6) Mr. C. S. Patel,
(7) Mr. S. R. Rane,
(8) Mr. J. H. Shamsuddin,
(9) Mr. M. M. A. Bhaiji,
(10) Mr. P. R. Shah,
(11) Dr. H. V. Desai, and
(12) Thakore Saheb Mansinghji Bhasaheb of Kerwada.

2. The meetings of the Committee were held in the Council Hall, Bombay, on e 8th, 10th, 11th, 16th, 17th, 23rd and 28th March 1949. The Accountant General, r. B. C. Dutt, was present by invitation. The report in its final form was signed 28th March.

3. We considered the statement of action taken by Government on the recom-endations made by the Public Accounts Committee last year (Appendix "A" to is report), the Appropriation Accounts of 1946-47 and the Audit Report thereon, d a note submitted by the Finance Department on the procedure in respect of e utilisation of unanticipated credits (Appendix "B" to this report).

4. The second item in the statement of action taken (Appendix "A") pertains the increase in losses under "Medical Stores" on account of wear and tear. It as explained that the increase was partly due to the fact that some medical officers charge of stores had calculated the loss on the basis of the market value of the ticles written off, so that, with the increase in prices, the estimated amount of sses had also increased. It appears, however, that the practice is not uniform other medical officers estimate the losses on the basis of the book value of the ticles written off. It is necessary that the procedure should be uniform. We derstand that Government has appointed an Accounts Officer and staff under e Surgeon General for introducing a uniform accounts procedure. The result the steps taken to ensure uniformity may be reported to the Committee next ear. It was mentioned that the amount of Rs. 64,886 appearing under Medicines, rugs, Dressings, etc. (column 3, Page 120 of the Appropriation Report) did not epresent "losses" under that head. The mistake, if any, may be investigated, nd the correct position intimated to the Committee next year.

5. Last year, the Public Accounts Committee recommended the appointment f a small committee consisting of the Accountant General (as Chairman), member of the Public Accounts Committee, the Secretary Finance Department, and the two Secretaries of the Public Works Department, o examine the question of re-grant of lapses and also the question of rush of Public Works Department expenditure in the closing months of the

year. The report made by that Committee is reproduced in Annexure of Appendix "A". The two main suggestions contained in the report are th it is not necessary to reintroduce the system of re-grant of lapses, but that the syst of lump cuts may be adopted in the interest of better budgeting. We agree w these recommendations and note that the system of lump cuts has already b put into effect in the next year's budget. As regards rush of expenditure, Committee presided over by the Accountant General has recommended that revised formula already adopted in this connection (for determining whether th is rush of expenditure) should be tried for some time. We endorse the recommen tion. Another suggestion contained in the report is that the more glaring ca of rush of expenditure should be reported to the Public Accounts Committee ev year and that at the same time the success achieved by individual officers in avoi rush of expenditure should be recognised in some way. We agree with the for recommendation. Whether the latter suggestion is also feasible we leave it Government to decide.

6. Item (6) in the statement of action taken relates to the introduction system of surprise checks of the stores of the Public Works Department. results of the system remain to be reported. The report may be made to year's Committee. We would emphasise that the element of surprise is of essence of such checks, which, accordingly, should neither be spaced regularly the whole year nor concentrated in any particluar part of it.

7. The next item relates to the question of setting up an independent ag under the Finance Department for checking the stocks and stores of certain de ments. Last year, the Committee recommended that the personnel then exp to be released from the Civil Supplies Department might suitably constitut nucleus of such an agency. Now that the staff from the Civil Supplies Depart is not likely to be available in the near future, we recommend that the questi setting up the organisation may be pursued independently and at an early d

8. Item (13) in the statement pertains to the recovery of arrears of c fees leviable under the Indian Electricty Act, 1910. The arrears are mainl from individual consumers, and not from electrical companies. We were ap of the steps taken by the Public Works Department for effecting the recov the arrears through the District Magistrates. But the arrears have by no decreased. A further report in respect of outstanding arrears may be made Committee next year. Apart from the question of recovery of past arrear necessary to see that arrears do not accumulate in future. The question a added importance in view of the projected extension of the Grid System recommend investigation of the question whether arrangements cannot be e into with Electrical Companies for the prompt recovery of fees from their cus and whether advance payment of fees cannot be made compulsory in law.

9. As desired by the Committee last year, Government has furnished giving its view on the question of insurance of Government property, with reference to third-party insurance of motor vehicles owned by Government note is contained in Annexure 4 of Appendix "A". We agree with the of Government, but would remark that, for every state-trading scheme magnitude run on a semi-commercial basis, an insurance fund should be cons to which appropriate amounts should be credited every year, these amount treated as working expenses of the scheme. We note that an Insurance F this basis has been constituted for the State Transport Scheme.

10. The last item in the statement of action taken pertains to delay in the eparation of the Appropriation Accounts. Apparently, there is delay at practi-lly every stage of the preparation of the report. In our opinion, it would be ry convenient for the Public Accounts Committee to meet and conclude its rk well before the commencement of the Budget Session of the Legislature, and recommend that steps may be taken to expedite the compilation of the port so as to make this possible.

11. The following statement shows the excess appropriations and demands r the year 1946–47 :—

erial No.	Major Head of Account.	Excess Appropriation (Charged).	Excess Demand (Voted).
		Rs.	Rs.
1	9, Stamps	...	3,800
2	12, Charges on account of Motor Vehicles Acts ..	7,10,381	....
3	23, Appropriation for Reduction or Avoidance of Debt.	421	....
4	25, General Administration . ..	...	7,65,510
5	27, Administration of Justice	....	1,91,540
6	29, Police	....	2,79,854
7	30, Ports and Pilotage	....	83
8	37, Education	6	....
9	38, Medical	15,323	....
0	40, Agriculture	6,138	....
1	42, Co-operation	....	52,234
2	47, Miscellaneous Departments	12,731	52,57,968
3	XLI, Receipts from Electricity Schemes . ..	79	....
	54, Famine	15,406	....
,	55, Superannuation Allowances and Pensions ..	....	6,99,822
5	56, Stationery and Printing	....	1,29,182
7	57, Miscellaneous	3,639	....
3	64-B, Civil Defence	1,769	4,31,378
)	81-A, Capital Outlay on Electricity Schemes .	5	....
)	83, Payments of Commuted Value of Pensions .	....	46,612
1	85-A, Capital Outlay on Provincial Schemes of State Trading.	726	8,98,55,700
2	Loans and Advances by Provincial Government	....	69,569
3	Public Debt	2,500	....
	Grand Total ..	7,69,124	9,77,83,252

consider the explanations offered as generally satisfactory and recommend t the excesses be approved by the Assembly.

year. The rep... h the excess under "47, Miscellaneous Depart-
of Appendix "... ia had raised debits very late in the year for the
it is not nece... whole milk powder, with the result that no
of lump cu... this expenditure. We understand that large
these re... e also raised, without sufficient notice, from
put int... y, in all such cases, that intimation should be
Co... Government, to enable it to make provision
re... nd that the question be taken up with the

...necessary and injudicious reappropriations and surrenders
..., non-surrenders of savings, defective budgeting, etc., are men
...ragraphs 15 to 20 of the Audit Report. We recommend that thes
... be brought to the notice of the departments concerned with a view to th
avoidance of similar mistakes in future. We mention below some of the mo
important irregularities :—

Paragraph 15.—Grants Nos. 4, 8 and 22.
Paragraph 16.—Grant No. 10.
Paragraph 17.—Grant No. 22.
Paragraph 18.—Grants Nos. 8 and 42.
Paragraph 19.—Grant No. 21.

14. We note that a large saving of about Rs. 30½ lakhs has occurred under "
Agriculture—M-Special Development Programme" on account of smaller purcha
of food-grains for seed purposes by the Collectors. It appears that there is a
agency for the purchase of seeds. Purchases of seeds of improved strains are m
by the Agricultural Department, while purchases of ordinary seeds are made thr
the Collectors. Whether, except perhaps in years of famine, there is any real
to purchase ordinary seeds, and, even if there is, whether the Agricultural De
ment may not be entrusted with these purchases as well, are administrative ma
for Government to consider. But whatever the system of purchase adopt
should be such as to allow of proper budgeting and timely surrender. We recom
that the question should be examined by Government.

15. Paragraph 22 (*a*) of the Audit Report refers to the starting of
P. W. D. Works without the preparation of detailed plans and estim
It appears that, with a view to expediting the execution of the Post-war R
struction Programme, Government issued orders permitting the starting of
in anticipation of technical sanction. We understand that these orders hav
been cancelled and that hereafter works will not be started before the detailed
and estimates are technically sanctioned, save in emergent cases and the
with Government's permission. As regards sub-paragraph (*b*) of the same para
we understand that Government has decided not to extend beyond 31st Marc
the period of relaxation of the rules concerning scheduled rates and that
are being issued in pursuance of this decision.

16. In paragraph 27 of the Audit Report, mention is made of various irregu
noticed during the local inspection of the P. W. D. divisions. We reco
that steps should be taken to minimise the delays on the part of sub-di
officers in complying with the inspection notes.

17. On page 184 of the Appropriation Accounts, under Grant No. 22, is m
the loss of an amount of Rs. 1,607-6-0 in January 1946 from a safe in the He
of the Labour Welfare Department. The case was reported to the Police but
ed undetected. Government ordered that certain amounts should be r
from the two persons responsible for the custody of the money, viz., the

12. We note, in connection with the excess under "47, Miscellaneous Departments", that the Government of India had raised debits very late in the year for the supply of skimmed milk powder and whole milk powder, with the result that no provision could be made for meeting this expenditure. We understand that large debits on account of food supplies are also raised, without sufficient notice, from time to time. It is obviously necessary, in all such cases, that intimation should be given well in advance to the Provincial Government, to enable it to make provision for meeting the debits. We recommend that the question be taken up with the Government of India.

13. Various cases of unnecessary and injudicious reappropriations and surrenders uncovered excesses, non-surrenders of savings, defective budgeting, etc., are mentioned in paragraphs 15 to 20 of the Audit Report. We recommend that these should be brought to the notice of the departments concerned with a view to the avoidance of similar mistakes in future. We mention below some of the more important irregularities :—

Paragraph 15.—Grants Nos. 4, 8 and 22.
Paragraph 16.—Grant No. 10.
Paragraph 17.—Grant No. 22.
Paragraph 18.—Grants Nos. 8 and 42.
Paragraph 19.—Grant No. 21.

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Labour Welfare Officer and the Cashier. Before, however, the orders were issued, the former officer resigned and his resignation was accepted by the Director of Labour Welfare. Government thereafter decided to write off 50per cent. of the loss and directed that the balance should be recovered from the cashier. We notice two irregularities in this case. The resignation of the Assistant Labour Welfare Officer should not have been accepted by the Director of Labour Welfare when he knew that the question of taking action against him for the loss of money was being considered. It appears further that full pay for the month of March was allowed to be drawn by the Assistant Labour Welfare Officer on 2nd April by the Director, even though the Director had already received the orders of Government directing the recovery of a certain amount from the Assistant Labour Welfare Officer. In the circumstances stated, the pay should not have been allowed to be drawn.

18. Another case of loss of Government money by theft is reported under Grant No. 40 on page 265 of the Appropriation Report. The box containing the money was not sealed before being deposited in the Reserve Bank. The present practice, we understand, is to keep boxes containing collections of money from the Government grain shops in the Old Custom House along with the cash of the Excise Department. We recommend that these boxes should, in future, be invariably sealed.

19. On page 196 of the Appropriation Accounts, an expenditure of Rs. 1,84,345 is shown as incurred, in the two years 1945-46 and 1946-47, on account of the grant of certain concessions to Government servants. These concessions are (*i*) the provision of malis at Government expense for gardens attached to Government residential buildings, and (*ii*) the payment of water charges for the gardens by Government. The concessions, which are in the nature of relief to Government servants from the increased cost of living were, it was explained to us, partly occasioned by the need to preserve Government property in good condition. Since, whilst examining the question of continuance of the concessions, Government will no doubt take into account the financial and other considerations involved, we have no special comment to make on the item.

20. A case of an unnecessary payment having to be made on account of the failure to observe the rules and terms of a contract is reported on page 195 of the Appropriation Accounts. A total amount of Rs. 1,05,000 was paid as compensation to the contractors entrusted with the work of construction of an R.C.C. Bridge and its approaches. The compensation was based on various considerations, one of which was that a breach of contract had been committed by Government in that certain additional items of work relating to the approach roads had been entrusted to another Contractor without an option having been given to the original contractors to tender for and execute the additional work. We were informed that the Executive Engineer entrusted the work to another contractor, because he considered that the original contractors would not be able to execute it in time, as their hands were already full. From the papers placed before us it was not clear whether the Executive Engineer had taken Government's permission before entrusting the work to another contractor and whether the legal aspect of the matter had been specifically considered at that time, as it should have been, either by him or by the Public Works Department. These questions may be further examined and the correct position reported to next year's Committee.

21. We have perused the note prepared by the Finance Department on the procedure in respect of the utilisation of unanticipated credits, and consider that the position should be further reviewed before any decision is taken to alter the existing procedure which was introduced only last year. We recommend

that the practice followed by other provinces be meanwhile ascertained and the matter brought up again before next year's Committee. It was explained that the introduction of a system of token grants would facilitate the adoption of the revised system of utilisation of unanticipated credits which has been introduced by the Central Government. The system of obtaining token grants does not prevail in this Province, such grants having been ruled out some years ago, on legal grounds, by the Speaker of the Assembly. We recommend that the desirability and feasibility of introducing the system be investigated by Government.

22. During the discussions, a question was raised about the provision to be made for the payment of interest on Provincial loans. Usually, the full amount of interest which falls due in a year is not drawn in that year, and arrears accumulate. It appears to have been suggested that, since payment of interest is a statutory liability, provision should be made in the Budget for the full amount due, inclusive of past arrears. But this, obviously, will not make for accurate budgeting. The practice followed in this province is to restrict the provision to the amount expected to be drawn on the basis of past actuals or other available data. This, it has been ascertained, is also the practice followed by the Government of India. We came to the conclusion that this practice might be continued. It is understood, of course, that all claims will be met, even if the budget provision is exceeded.

23. In conclusion, we put on record our thanks to the Accountant General, Mr. B. C. Dutt, for the valuable assistance we have throughout received from him.

Bombay, 28th March 1949.

VAIKUNTH L. MEHTA.
N. S. KAJROLKAR.
S. R. RANE.
POPATLAL R. SHAH.
M. N. MEMANE.
GANESH W. JOSHI.
R. S. HUKERIKAR.
HARIPRASAD V. DESAI.
M. M. A. BHAIJI.
J. H. SHAMSUDDIN.
MANSINGHJI BHASAHER.
C. S. PATEL.

APPENDIX A.

Statement showing the action taken by Government on the recommendations made by the Public Accounts Committee in their Report dated the 3rd March 1948 on the Appropriation Accounts for 1945–46, and on the outstanding points in the previous reports.

Serial No.	Paragraph of the Committee's Report.	Page and paragraph of the Appropriation Accounts.	Recommendation or observation of the Committee.	Action taken by Government.
1	2	3	4	5
1	6	.....	The formula for determining rush of expenditure in the Public Works Department prescribed in the Public Works Department Manual limits the expenditure in March to double the average monthly expenditure during the preceding eleven months of the year in the case of normal divisions and three times the average in the case of certain specified divisions of that Department. In view of the considerations brought to its notice by the Public Works Department the Committee recommended that the existing limits should be raised to three times the average for normal divisions and four times the average for the special divisions.	The recommendation has been accepted and the limits have accordingly been raised.
2	7	Page 115. (Store Account relating to the major head "38 - Medical".)	The Committee noticed from the latest Medical Store Account incorporated in the Appropriation Accounts for 1945–46 that the losses due to wear and tear had further increased during 1945-46. In particular, the writes-off under "Instruments and appliances" amounted to as much as Rs. 26,750. The Committee, therefore, recommended that the question of minimising these losses should be further investigated by the Health and Local Government Department and that a report should be submitted to the succeeding Public Accounts Committee.	The question has accordingly been investigated further in consultation with the Surgeon General and it has been found that to a certain extent the losses are due to non-observance of uniform classification in the store accounts by the Medical Officers in charge of the major institutions. The question of introducing a system of uniform classification is being examined. The Surgeon General is also of the opinion that departmental inspection and check will have to be introduced in respect of the store account since mere insistence on uniform classification will not be very helpful in minimising the large amounts of writes-off, and

APPENDIX A—*contd.*

Serial No.	Paragraph of the Committee's Report.	Page and paragraph of the Appropriation Accounts.	Recommendation or observation of the Committee.	Action taken by Government.
1	2	3	4	
				has, therefore, suggested appointment of an Account Officer with a small staff for the purpose. This, in his opinion, is likely to provide the necessary guidance to and check on the officers concerned in maintaining correctly and regularly the several registers, returns and accounts. The suggestion of the Surgeon General is under the consideration of Government in the Health and Local Government Department.
3	8		Regarding the system of regrant of lapses which could not be given fair and adequate trial by the Public Works Department the Committee recommended that the question of implementing the system should be examined in all its aspects by a small Committee consisting of a Member of the Public Accounts Committee, the Accountant General, the Finance Secretary and the two Secretaries of the Public Works Department. The Committee also expressed that it would be useful if the proposed Committee examined a few concrete cases and also investigated the suggestion to combine the system of regrant of lapses along with the system of lump cuts. It was desired that the proposed Committee's report should be placed before the next Public Accounts Committee.	The report of the Committee appointed by Government in pursuance of this recommendation is attached (Annexure I).
			The Committee expressed its opinion that the question of minimising the delay between passing of the budget and communication to disbursing authorities of the budget allotments was of special importance in connection with the provisions for village water supply, and directed that the effect of the orders issued by the H. & L. G. D. in this connection should be watched and a report thereon should be submitted to the Committee.	All the District Collectors were asked to report whether advance intimation of grants provided in the Budget for village water supply helped the District Local Boards and the Executive Engineers concerned to draw the grants earlier than hitherto. The reports received so far from the Collectors indicate that the orders in question have been helpful in speeding up the distribution of the grants.

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Serial No.	Paragraph of the Committee's Report.	Page and paragraph of the Appropriation Accounts.	Recommendation or observation of the Committee.	Action taken by Government.
1	2	3	4	5
5	11	.....	The Committee noted that the legal advisers of Government had confirmed the feasibility of the course suggested by that body in its preceding year's Report, viz. of proceeding simultaneously against principal and sureties in the process of recovery of arrears of revenue or fees. The Committee therefore suggested that instructions should issue to all Departments for the adoption of that course.	The requisite orders have been issued.
6	12	.....	The Committee directed that the result of the instructions issued by the Public Works Department in pursuance of a recommendation of the preceding Committee about frequent recourse to surprise checks of stores in the Public Works Department should be communicated to the next Public Accounts Committee.	The instructions referred to by the Committee were issued only in the beginning of 1948 and no reports of tangible results are yet available. The necessary report will be made to the Committee next year.
7	13	.....	In connection with the question of instituting a system of independent checks of stores, i.e., check by an authority outside the department to which the particular store account pertains, the Committee recommended that, to start with, such a system should be constituted, as soon as administratively convenient, in respect of the stores pertaining to the Public Works, Agriculture and Medical Departments. The Committee considered that the stock verification staff employed by the Civil Supplies Department would be a suitable nucleus for the purpose. The Committee further recommended that the agency for independent checks, when constituted, should be placed under the direct control of the Finance Department.	The recommendation has been accepted in principle by Government. As, however, the Civil Supplies Department (on account of reimposition of controls) and the Central Stores Purchasing Officer (on account of paucity of experienced staff) are unable to spare suitable personnel even for a nucleus organisation it is not yet feasible to introduce the system. The question is being pursued, and, as recommended by the Committee, the system will be instituted as soon as administratively convenient.

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Serial No.	Paragraph of the Committee's Report.	Page and paragraph of the Appropriation Accounts.	Recommendation or observation of the Committee.	Action taken by Government.
1	2	3	4	5
8	14	Pages 3–5, paragraph 7.	The excess grants and appropriations were recommended by the Committee for sanction.	The excesses have been sanctioned.
9	16	Pages 11–13, Paragraphs 15–21.	The Committee recommended that the various cases of unnecessary and injudicious reappropriations and surrenders, uncovered excesses, non-surrenders of savings, defective budgeting, etc., mentioned in paragraphs 15 to 21 of the Audit Report should be brought to the notice of the Departments concerned with a view to avoidance of similar mistakes in future.	The recommendation of the Committee has been carried out.
10	17	Page 19, paragraph 27.	(*a*) In connection with the irregularities mentioned in paragraph 27 of the Audit Report which pertained to the Public Works Department it was explained to the Committee that the recurrence of these irregularities was to some extent unavoidable in the conditions created by the war, in particular, the lack of qualified personnel. The Committee, however, considered that the recurrence of large number of such irregularities year after year was unsatisfactory. It, therefore, recommended that special attention should be paid to the training and examination of Sub-Divisional Officers in accounts matters. It also recommended that the Public Works Department should issue suitable instructions to its officers with a view to minimising such irregularities in future. (*b*) In particular the Committee desired to have a detailed report on the irregularities noticed in respect of the case of the construction of a re-inforced cement-concrete bridge across the Bhima river which was specifically brought to the notice of that body by the Accountant General.	(*a*) As regards the training of the Sub-Divisional Officers the Public Works Department does not consider it to be practicable except at a prohibitive cost. Nor does that Department consider such a training necessary; first, because under the existing rules the Assistant and Deputy Engineers who hold the charge of Sub-Divisions are required to pass within a period of three years from their appointment or promotion to the respective posts a professional examination one of the subjects for which is "Accounts and Rules of the Public Works Department" and, secondly, because these officers are in a position to acquaint themselves with the accounts procedure while carrying out their professional duties. The recurrence of a large number of irregularities in accounts matters is, according to that Department, due to raw hands being made Deputy Engineers owing to rapid expansion of the Department and such irregularities are expected to disappear as the newly

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Serial No.	Paragraph of the Committee's Report.	Page and paragraph of the Appropriation Accounts.	Recommendation or observation of the Committee.	Action taken by Government.
1	2	3	4	5
				promoted officers gain experience and pass the professional examination. However, with a view to giving an incentive to these officers to pass their examination as early as possible, it has been decided to reduce the existing prescribed period of three years for passing the examination to two years and to make the grant of second increment to them contingent upon their passing the professional examination. As regards the latter recommendation, the Public Works Department has issued suitable instructions to its officers. (*b*) The requisite detailed report is attached. (Please see Annexure 2.)
11	19	Page 144, paragraph 4 (*b*).	In regard to the case of purchase and distribution of groundnut cake through a private agency on payment of commission without obtaining Government's sanction for the commission and without calling for tenders as required by rules, the Committee, having been informed about the departmental enquiry that was in progress against the officer concerned, recommended that the possibility of recovery of commission from either the officer or the private agent should be borne in mind at the time of passing orders on the enquiry.	Government decided not to take further action with regard to the recovery of the commission from either the officer or the private agent as the officer concerned had been dismissed from Government service.
12	20	Pages 184–185, paragraph 7.	The Committee recommended that the circumstances in which the excess payment of Rs. 3,214 came to be made to a contractor in the case reported in paragraph 7 of the "Important Comments" under "Grant No. 23—Civil Works" should be further investigated with a view to fixing responsibility.	The matter has accordingly been further investigated by the Public Works Department and the officers found responsible for the irregularity have been warned to be more careful in future. Further, with a view to avoiding recurrence of such irregularities, the Public Works Department has issued a general

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Serial No.	Paragraph of the Committee's Report.	Page and paragraph of the Appropriation Accounts.	Recommendation or observation of the Committee.	Action taken by Government.
1	2	3	4	5
				circular to its officers explaining the danger involved in taking borrow pit measurements of excavation in cuttings and containing necessary instructions regarding the correct method of taking intermediate measurements and the allowance to be made for voids.
13	21	Page 185, paragraph 8.	As regards the arrears of fees payable by various electrical companies for services rendered by Government's staff of Electrical Inspectors the Committee considered that the process of recovery has been dilatory and unsatisfactory. It, therefore, recommended that prompt steps should be taken for the recovery of arrears some of which dated back to 1936-37. The Committee further recommended that the rules framed under the Indian Electricity Act, 1910, and the procedure prescribed for recovery of fees under those rules should be carefully examined and suitably altered so as to ensure prompt payment. In this connection the Committee specifically drew attention to rule 3 and recorded its opinion that it might be desirable to amend that rule so as to make it invariably compulsory for the companies to pay fees before inspection. The Committee further directed that it should be examined whether the rules should not provide for cancellation of licence as penalty for non-payment. The feasibility of recovering unpaid fees as arrears of land revenue was another point suggested by the Committee for examination in this connection.	Please see Annexure 3.

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Serial No.	Paragraph of the Committee's Report.	Page and paragraph of the Appropriation Accounts.	Recommendation or observation of the Committee.	Action taken by Government.
1	2	3	4	5
14	22	Page 247, paragraph 4 (*ii*)	The Committee regarded as unsatisfactory the practice of entrusting to dalals the work of obtaining refunds of town duties from the Bombay Municipality on foodgrains, etc., despatched on Government account by the Civil Supplies Department from Bombay City to outside areas. On being informed that the matter regarding the course to be adopted for obtaining refunds from the Municipality was under negotiation with that body the Committee suggested that report on the arrangement decided upon in consultation with the Municipality should be submitted to the succeeding Public Accounts Committee.	The dalali system has been discontinued from 1st September 1948 and the work of calculating and claiming refunds of town duty from the Municipality and watching the recovery is now being carried out departmentally. The Civil Supplies Dept. has made arrangements for maintaining the requisite records. These will enable it to claim the proper refunds of town duty and to watch the recovery thereof.
15	23	Page 254, Foot-note below the Trading and Profit and Loss Account of the Govt. Grain Shops Scheme, Bombay.	The Committee recommended that its observations regarding the case of a write-off of Rs. 4,93,174 representing the value of potatoes which had become rotten and unsaleable should be communicated to the officers concerned and also brought to the specific notice of the Honourable Ministers in charge of the Agricultural and Civil Supplies Departments in order that suitable steps might be taken to ensure that lack of co-ordination of that type did not recur.	The recommendation has been carried out.
16	24	.....	In considering individual instances of losses incurred by Government through the negligence or positive misconduct of its servants, the Committee noticed a tendency to be unduly lenient to the person responsible. This tendency	The observations of the Committee have been brought to the notice of all the officers concerned and the requisite instructions have been issued.

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Serial No.	Paragraph of the Committee's Report.	Page and paragraph of the Appropriation Accounts.	Recommendation or observation of the Committee.	Action taken by Government.
1	2	3	4	5
			was particularly noticeable when the responsibility for the guilty act or omission was shared by several persons. This was considered by the Committee to be illogical and administratively unsound and it recommended that the instructions regarding investigation of cases involving loss of Government money or revenue already issued by Government in the preceding year at the instance of that body should be amplified and a warning against the tendency mentioned above should be conveyed to the officers empowered to pass orders on departmental enquiries into misconduct or negligence.	
17	25	.....	The Committee recommended that a statement of Government's views on the question of insurance of Government property, with special reference to the desirability of insuring against third-party risk the motor vehicles owned by Government should be placed before the succeeding Public Accounts Committee.	Please see Annexure 4.
18	26	.....	The Accountant General brought it to the notice of the Committee that considerable delay in the compilation of the appropriation accounts had been caused, during the past few years, by the dilatoriness of some departments and that much inconvenience had thereby resulted. The Committee, therefore, recommended that the importance of dealing promptly with the references pertaining to the appropriation accounts should be impressed strongly on all the Departments of Government.	The Committee's remarks h been specifically brought the notice of all the Dep ments and Control Officers, and neces instructions have been iss to them.

ANNEXURE 1.

(*Vide* Item 3 of Appendix A.)

Report of the Committee on the question of implementation of the system of regrant of lapses combined with the system of lump cuts.

The Committee constituted under the Government of Bombay, Finance Department Resolution No. 3598, dated the 25th June 1948, to examine the question of regrant of lapses combined with the system of lump cuts and the question of reduction of rush of expenditure in the Public Works Department in the closing months of the year, comprising the following members met at 2–15 p.m. in the office room of the Accountant General, Bombay, on Monday, the 15th November 1948 :—

Mr. B. C. Dutt, M.A., I.A.A.S., Accountant General, Bombay. Chairman.

Mr. Chhotabhai S. Patel, M.L.A.
Mr. B. S. Vyas, B.E., M.I.E. (Ind.,) I.S.E., Chief Engineer and Secretary to the Government of Bombay, Public Works Department (Roads and Buildings).
Mr. N. P. Gurjar, B.E. (M), I.S.E., Chief Engineer and Secretary to the Government of Bombay, Public Works Department (Irrigation). } Members.
Mr. B. Venkatappiah, I.C.S., Secretary to the Government of Bombay, Finance Department.

Mr. D. E. Mahajan, B.A., Assistant Secretary to the Government of Bombay, Finance Department ... Secretary.

2. *Regrant of Lapses.*—In view of the procedure, now in vogue in this Province, of reallotting funds during the succeeding year in all cases of legitimate postponement of expenditure in the current year, and of authorising expenditure, where necessary, in anticipation of allotment of funds, the Committee consider that there is no real necessity for the introduction of a system of regrant of lapses.

3. *Rush of Expenditure.*—The Public Accounts Committee which considered the Appropriation Accounts for 1945–46 and the Audit Report, 1947 have suggested revision of the existing criterion for judging whether there has been rush of expenditure in the closing months of the financial year. If this recommendation be acceptable to Government the Committee feel that the revised formula should be given a fair trial for a reasonable period.

4. *Glaring and typical cases.*—The Committee think that it would be of advantage to bring to the notice of the Public Accounts Committee, every year, a few of the more glaring or typical cases of rush of expenditure, *i.e.*, cases indicating large and undoubted rush of expenditure even after elimination of the effect of factors which are beyond the control of the departmental officers *e.g.*, unusual monsoon or non-arrival in time or in sufficient quantity of materials already ordered for etc. The Committee would also suggest for the consideration of Government whether it would be helpful to recognise periodically in some way the good work done by departmental officers in avoiding all rush of expenditure and in managing prudently the funds placed at their disposal during the year.

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5. *Duties of Departmental Officers.*—The committee realise that the uncertainty and irregularity of the monsoon, the non-availability of labour during the agricultural season and the difficulty of securing necessary materials in a regular flow and in adequate quantities are bound to impede the uniform progress of work throughout the year. Nevertheless, the Committee consider that the rushing of work inevitably involves hurried measurements and hurried payments and therefore militates against the best interests of Government. They would, therefore, suggest to Government the issue of a self-contained circular embodying the existing relevant orders on the subject and pointing out to all disbursing officers the undesirability of, and risks associated with, all rush of expenditure and laying stress on the importance and the method of proper control by the departmental officers over the progress of, and expenditure on, works, and on timely review and free surrenders of anticipated savings. If Government consider it necessary it may also be pointed out to the disbursing officers that Government would be prepared to place funds at their disposal in all cases of legitimate postponement of work during the ye This would remove from the minds of the disbursing officers any fear that t failure, for valid reasons, to spend in one year would not necessarily be followed b a reduction of grant in the succeeding year.

6. *Lump cuts in grants.*—The information placed before the Committee regardin grants and actual expenditure for successive years indicates that savings are no infrequently due to several factors which are beyond the control of departmenta officers, *e.g.*, delayed or heavy monsoon, non-availability of labour during the harves and the difficulty in securing essential materials in adequate quantities or at th required rate. The Committee consider that, in view of these fairly commo obstacles in the way of execution and completion of various items of work in th Public Works Department and some other departments, lump cuts in grants woul help to achieve a closer approximation between grants and actual expenditur The amount of the lump cut in the grant should, in the opinion of the Committe be based on a consideration of all the relevant factors, including the average savin in the particular grant over not too short a period of years.

ANNEXURE 2.

(*Vide* Item 10 (*b*) of Appendix A.)

Detailed report on the irregularities noticed in the case of the work of construction of the R. C. C. Bridge across the Bhima River at Hingangaon in the Sholapur Division.

In connection with the work of the construction of the R. C. C. Bridge across the Bhima River at Hingangaon, the following three irregularities were noticed :—

(1) Failure to provide in the agreement and to recover from the contractors the current price of cement (*plus* incidentals), thus involving Government in a loss agregating to Rs. 20,361-8-0.

(2) Non-insertion of the condition for the return of empty cement bags in the lump sum contract in contravention of Government orders, thus involving Government in a further loss of about Rs. 7,710.

(3) Extra cost involved in the change in the proportion of cement in mortar from 1 : 6 to 1 : 5.

The irregularities have been dealt with below.

2. *Irregularity* (1).—The crossing at Hingangaon which is located on a main strategic road (Poona-Sholapur Road) was closed for four months in a year on an average and caused serious obstruction to direct inter-communication. The work of constructing a bridge across the Bhima River at the above mentioned place was therefore ordered to be started by this Government and the tender of Messrs. S. B. Joshi and Company, Engineers and Contractors, was accepted. The Government of India were approached for sanction of a grant of Rs. 4,58,000 from the Reserve in the Central Road Fund to meet the cost of the work. The Government of India intimated that, although the work was desirable, it was not considered to be an "inescapable" military necessity, and therefore declined to give a grant from the Reserve in the Central Road Fund but added that if this Government still considered it necessary to proceed with the work, the entire cost should come either from the ordinary allocations to Bombay in the Central Road Fund or from the Provincial Revenues, subject to the condition that the Provincial allocation from the Central Road Fund should not be drawn if this would be to the detriment of the progress of her strategic works in this Province.

3. In view of the Government of India letter, this Government had originally decided to stop the work forthwith and orders to that effect were issued. As however, the tender of Messrs. S. B. Joshi and Company for the work had already been accepted towards the end of January, 1943, and with a view to avoid payment of compensation to the contractors and also to get the maximum useful work done by them out of the commitments already made by them, it was originally decided to continue work on the bridge upto a total value of Rs. 1,50,000 only against the estimated cost Rs. 4,58,000. The Government of India authorised expenditure not exceeding Rs. 1,50,000 towards the work in question from the allocation to this Province in the Central Road Fund. As the crossing at Hingangaon was considered to be a great necessity, it was decided to carry on the work to completion rather than leave Rs. 1,50,000 of "dead" money in the river with piers and abutments projecting out of the river for an indefinite period, especially since the work would have to be completed under the post-war-road programme in any event. This Government therefore allowed the contractors to complete the work in question. Hence the account of the contractors was not closed but a lump sum contract on

" C " Form was got completed with the rates of cement etc. already provided for in the original item rate tender. Had the rate of cement been increased, the contractors would naturally have quoted higher rates. Hence no provision of Rs. 67-8-0 per ton was made in the contract subsequently entered into. Besides, the supply of cement was not free. The supply of cement was controlled by the Chief Engineer, Southern Army, and that officer ordered the release of cement from Coimbatore instead of from Shahabad, as the latter cement factory was burdened with military orders of high priority and, as a result, the cost of cement was almost doubled due to longer journey and ultimate extra railway freight. This fact was brought to the notice of Government by the Superintending Engineer, Central Circle, in July 1943 and a general case was made out and final orders were issued under Government Letter No. 5949/36-(I)-C., dated the 9th August 1943, to revise the estimate accordingly due to increased cost of cement. The alteration in the type of the tender form from item Rate B-2 to Lump Sum " C " did not contemplate change in rate for supply of cement. Taking into consideration the very wid[e] and rapid fluctuations in cost of cement arriving from factories over long distanc[e] then, no useful purpose would have been served by inserting a rate for supply of cement prevailing at that particular time but which would not hold for all time as true. The fixing of the lump sum contract hinged on the old rate of cement. Had the rate for supply of cement been altered and raised, the price of the lump sum contract would have been proportionately higher. It will thus be seen that no loss to Government has accrued on account of the rate for supply of cement not being fixed at Rs. 67-8-0 *plus* incidentals.

4. *Irregularity* (2).—Public quotations were invited for the work of the bridge over the River Bhima at Hingangaon on the Poona-Sholapur Road and the quotation of Messrs. S. B. Joshi and Company for Rs. 4,39,311 was accepted. Subsequently the work was postponed as Government of India were not prepared to share the cost of construction. Further on, this Government decided to carry the work to completion and the contractors were allowed to resume the work on the basis of the quotations accepted originally. As in the original agreement entered into by the contractors there was no clause regarding return of empty cement bags, this clause could not be inserted in the fresh tender subsequently accepted on the assumption that if this would be done now, the contractors would claim extra payment to compensate the loss on this account. This matter was held under objection by the Accountant General, Bombay, who asked the Superintendi[ng] Engineer, Central Circle, to obtain Government sanction.

5. The first quotations were invited and accepted over a year earlier than the date of issue of orders regarding the return of empty cement bags. When the suspended work was resumed, the new agreement, though drawn up after the issue of the orders regarding the return of empty cement bags, was based on the old quotations and as such it was not desirable to add the new clause. If such a clause was insisted upon, the contractors would certainly have claimed higher rates and no financial gain would have accrued to Government, and no loss has accrued by the adoption of the present procedure. Government therefore approved the Superintending Engineer's action in not inserting the clause regarding return of empty cement bags in the fresh agreement with the contractors.

6. *Irregularity* (3).—The Inspecting Officer of the Accountant General, Bombay pointed out in paragraph 12 of his report, that the contractors' quotation for masonry work roughly 200,000 Cubic feet was for 1 : 6 mortar to be used in masonry work and the Public Works Department wanted 1 : 5 mortar to be used in masonry work,

ANNEXURE 2—*contd.*

he contractors were thus supplied with 165 tons of cement free of charge, ntailing extra cost of Rs. 11,880 to Government. As regards this point, is pointed out that the change in the proportion of cement in mortar from 1 : 6 1 : 5 was decided by the then Superintending Engineer, Central Circle, at the me of inspection of the work from the point of view of safety, and he ordered that he extra cement required to make the richer mixture may be supplied to the ontractors and the cost debited to the work. This change was necessitated after nspection of situation on site work during construction and could not be nticipated. The tenders for the work were based on original Government design nd the contractors were allowed to submit their own design and quotations while ubmitting their tenders. Accordingly some designs were received and after full onsideration the lump sum tender of Messrs. S. B. Joshi and Company based on eir own design was finally accepted by Government. This design provided for ll masonry work in cement mortar with proportion of 1 : 6. Accordingly the work was started and the masonry work was done in cement mortar with the above noted proportion. As stated above, in the course of one of his inspections during 1943 the then Superintending Engineer issued instructions to change the proportion as richer mixture was considered desirable to give proper strength to the masonry. The specification provided that the masonry should be in cement mortar in proportion of five parts of river sand and one part of cement and in order to maintain this proportion, the contractors were supplied with extra quantity of cement at site of work, free of cost by Government.

ANNEXURE 3.

(*Vide* Item 13 of Appendix A.)

Recommendations in paragraph 21 of the Public Accounts Committee's report for speedy recovery of accumulated arrears of fees for the services of Electric Inspectors and for avoiding such arrears in future.	The decision taken by Government in the Public Works Department.	The reasons underlying the decisions in the preceding column.
1	2	3
(1) The process of recovery has been dilatory and unsatisfactory. Prompt steps should now be taken for recovery of arrears of fees.	(1) The District Magistrates concerned have specifically been asked in October 1948 to effect the recovery of accumulated arrears of fees within three months and if not, to justify the delay and state the difficulties they find in clearing such arrears and also to state whether some of the recoveries are time-barred and cannot be effected under law so that steps may be taken to write them off.	(1) The Assistant Electric Inspectors are prompt in reporting the names of the defaulters to the District Magistrates. It must, therefore, be possible for the District Magistrates to recover the fees promptly according to the procedure laid down in section 54 of the Indian Electricity Act. Necessary further action will be taken on receipt of the details from the District Magistrates.
(2) To avoid arrears of electric inspection fees in future, the following suggestions are made :—	(2) To avoid accumulation of arrears in future, it has been decided to have a suitable provision, if possible, in the Indian Electricity Rules, 1937, for a penalty for defaulters. The Electrical Engineer, who is the member of the Advisory Technical Committee set up by Government of India for revising the Indian Electricity Rules, 1937, will take up this question of providing for a penalty in the revised rules.	(2) The three recommendations made by the Public Accounts Committee and mentioned in column 1 of this statement are not feasible for the following reasons :—
(*a*) Rule 3 of the Rules for levy of inspection fees should be so amended as to make it invariably compulsory for the party concerned to pay the fees *before* inspection.	In the meanwhile, the Electrical Sub-Inspectors have been instructed to hand over the fee notice to the operator immediately after the inspection is over and try their best to collect the amount at site; otherwise ask the operator to inform the owner to pay the fees at the Electric Inspector's office within ten days, failing which his name would be reported to the District Magistrate for necessary action. This procedure has worked very well indeed at most of the places, as not only the recovery of the inspection fees but also the compliance	(*a*) Most of the parties refuse to pay the fees in advance. It will not be in order to insist on such advance payment as the fees are chargeable for the special services rendered by the Electric Inspectors, and besides, the statutory inspections are carried out primarily in the interest of public safety and as such, they will not admit of indefinite postponement because of the default in payment of fees in advance by any party.
(*b*) The feasibility of recovering unpaid fees as arrears of land revenue should be examined.		(*b*) The fees cannot be recovered as arrears of land revenue unless such a provision is made in the Indian Electricity Act, 1910. Besides, it is felt that the recovery of unpaid fees as "arrears of

ANNEXURE 3—*contd.*

ecommendations in paragraph 21 of the Public Accounts Committee's report for speedy recovery of accumulated arrears of fees for the services of Electric Inspectors and for avoiding such arrears in future.	The decision taken by Government in the Public Works Department.	The reasons underlying the decisions in the preceding column.
1	2	
	with the recommendations under the Indian Electricity Rules has been prompt.	dand revenue" will in no way improve the situation, as the amount recoverable in each individual case is very small.
(c) Provision for cancellation of license as penalty for non-payment of fees should be made in the Rules.		(c) The question regarding provision in the rules for cancellation of licenses as penalty for non-payment of fees does not arise, as there are no cases of arrears outstanding against the Electric Supply Companies, which are granted licenses to supply energy under section 3 of the Indian Electricity Act, 1910.

ANNEXURE 4.

(*Vide* Item 17 of Appendix A.)

Note by the Finance Department regarding Insurance of Government Properties.

The Public Accounts Committee, in its report on the Appropriation Accounts of 1945-46, has remarked that the question of insurance of Government property requires to be further considered and it has asked that a statement containing Government's views on the question with special reference to the desirability of insuring the motor vehicles owned by Government against third party risks, should be placed before the next Public Accounts Committee. This note is accordingly submitted.

2. Government's policy is that as a rule Government property should not be insured. The reason underlying this decision may be briefly explained by considering what would happen if Government were to insure, with one or more companies, a fleet of say 1,000 motor vehicles. (The actual number of Government owned motor vehicles excluding State Transport vehicles is at present 1,304).

The premium charged by the company may be separated into the net premium which represents the acturial equivalent of the probable loss to the motor vehicle due to accident during the period of insurance which is computed on the basis of available statistics regarding accidents and the loading which provides the agent's commission, the company's overhead expenses and profits and such other items.

So far as the part of the payment made by Government which is on account of the net premium is concerned, over a period of time, the annual payments made will after allowing for interest, just counterbalance the payments made by the Company to Government, the result of the insurance being merely that the losses incurred by Government during the period are spread evenly over it. But due to the number of vehicles involved, this result is achieved even without the insurance, such variations as occur being insignificant in comparison with Government's normal expenditure. Therefore so far as this part of the payment is concerned, insurance will in practice make little or no difference.

But the payment made on account of the element of loading in the premium will represent a definite loss to Government. The extent of loading varies with different types of insurance. It may be mentioned here that in the case of the State Transport vehicles an insurance company offered a premium of Rs. 150 per vehicle as against its book premium of Rs. 400. The net premium here therefore amounts to less than 35 per cent. of the book premium.

The loading may be much less in other cases but whatever it be it represents an avoidable loss to Government.

3. The case of an individual insurer stands on a somewhat different footing. In his case the effect of insurance is to spread the loss over a larger body of persons. In the case of Government the loss is already spread over a very large body of persons since it is borne by the tax payer; all that insurance can achieve is to spread the loss over a period of time.

4. This Government's policy of not insuring its property is in line with that followed by other Provincial Governments and the Government of India. This was revealed during the enquiries which were made in 1946 in connection with the quest

ANNEXURE 4—*contd.*

insurance of foodgrains. As the Commerce Department of the Government marked in one case relating to marine insurance of foodgrains "it has been the ractice as far as we are aware for Government to carry their own risk".

5. The considerations set out above apply to insurance against third party risks so and no special considerations seem to arise in respect of such insurance. either is such insurance on the part of Government obligatory under the law, nce section 94 (*1*) of Motor Vehicles Act, 1939, does not apply to motor vehicles wned by Government so long as the vehicle is under Government's control or is iven by a Government servant in the course of his employment (*vide* sub-section (*2*) section 94 of the Act).

APPENDIX B.

Note by the Finance Department regarding the utilisation and accounting of unanticipated credits.

I. *Point for consideration by the Public Accounts Committee.*—The question of the utilisation of unanticipated credits was examined by the Public Accounts Committee in March 1947 when it met for considering the Appropriation Accounts of 1944-45. Attention is invited to the note* which was then submitted to the Committee by the Finance Department. The procedure suggested in the note was approved by the Committee and was later adopted by Government after the ratification of the Committee's Report by the Legislature.

As explained in the note, according to the rules of Accounts classification, credits of certain types have to be shown as deductions from expenditure under the relevant Budget Heads. When actual recovery is greater than estimated in the budget additional funds become available to the controlling officers for incurring expenditure. The procedure outlined in the note, places some restrictions on the utilisation of these additional funds but it does not secure full control of the Legislature over them.

This procedure was in line with that which was then followed by the Government of India. That Government have however recently revised their procedure. The new procedure secures that the additional funds due to unforeseen recoveries are not utilised by the controlling officers for financing expenditure not approved by the Legislature and that the positive assent of the latter is obtained to all additional expenditure, thus *prima facie* securing complete control of the Legislature over actual expenditure. The question whether our procedure should be similarly revised requires to be considered.

II. *Present procedure of this Government.*—The present procedure places the following restrictions on the utilisation of unanticipated credits.

(*a*) These credits cannot be utilised for meeting expenditure on *new items* of service. Expenditure on new items can only be incurred from a supplementary grant sanctioned by the Legislature.

(*b*) Cases in which excess in gross expenditure due to other than new items is covered wholly or in part by unanticipated credits are to be specifically brought to the notice of the Public Accounts Committee through the Appropriation Accounts.

(*c*) Such of the cases of the category (*b*) as are noticed before framing the revised estimates are mentioned in the explanatory remarks below the relevant budget heads in the Budget Memorandum.

III. *Revised Procedure of the Government of India.*—The revised procedure as under :—

(*a*) Savings in the subheads of grants accommodating recoveries will not be available for reappropriation to cover excesses under other subheads except subheads accommodating other recoveries. The unutilised savings in these subheads will be allowed to lapse and suitably explained in the Appropriation Accounts.

(*b*) The approval of the Legislative Assembly to any additional expenditure over the amount voted by it for the gross expenditure in a grant will be taken by means of a supplementary grant. The supplementary grant will take into accou

*Printed as Appendix " C " to the Committee's Report, 1947.

the unforeseen additional recoveries in the course of the year and will be taken for the net excess over the total grant, details of the gross expenditure and of the recoveries being placed before the Assembly. If the net effect of the additional recoveries is to reduce the total expenditure against the grant to a figure less than the original grant or to reduce it to a minus figure the Assembly's approval to the increase in the gross expenditure will be taken by means of a *token grant.*

The excess under the subheads for gross expenditure which would have been covered by re-appropriation of savings but for the prohibition in sub-paragraph (*a*) will be suitably explained in the appropriation accounts.

The procedure set out above will apply *mutatis mutandis* to non-voted expenditure. Finance Department will authorise the additional expenditure for which in the case of voted expenditure the Assembly is approached for a supplementary grant.

IV. *Note by the Accountant General.*—The Accountant General considers that as all voted expenditure has to be restricted to the amount actually voted by the Legislature, it would be incorrect and undesirable to allow the controlling officers to spend a larger gross sum than is approved by the Legislature. According to the existing Provincial practice it would be possible for the controlling officers to incur gross expenditure in a grant in excess of the amount voted by the Legislature, by reappropriating funds from a "Deduct" to a "Gross" head in certain cases. To this extent therefore the effective control of the Legislature is avoided or nullified. This is, however, not possible under the Government of India's new procedure. He therefore considers that the present procedure should be suitably revised.

V. *Comments by the Finance Department.*—It may be noted that the Government of India's procedure cannot be adopted by us in toto because that procedure involves asking token demands in those cases where there is no increase in net expenditure, the increase in gross expenditure being wholly counterbalanced by additional recoveries. Our Legislature has however ruled out token demands.

Since token dmands are not permitted the only alternative open to us would be to ask for a supplementary grant to cover the whole increase in gross expenditure. For the sake of uniformity this will have to be done in all cases, i.e., in those cases where there is decrease in net expenditure as also in those where there is increase. The procedure thus involves asking of inflated grants with large resultant savings which are allowed to lapse.

The procedure in question is already being followed in those cases where the increase in gross expenditure is on account of new items of service. The modification required in the present procedure is thus that a supplementary grant to cover the increase in gross expenditure would be asked for irrespective of whether such increase is due to new items of service or not.

To summarise, the Government of India's new procedure cannot be adopted by us *in toto*, due to the ruling of our Legislature. A modified procedure which conforms with the ruling and which secures the same object as the Government of India's procedure can be devised but the procedure is not free from objections as it involves asking of inflated demands with resultant large savings.

The matter is now placed before the Committee for its consideration and advice.

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